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DEPARTMENT OF DEFENSE AUTHORIZATION FOR APPROPRIATIONS FOR FISCAL YEAR 1996 AND THE FUTURE YEARS DEFENSE PROGRAM

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PT. 7
Department of Defense Authorization...

HEARINGS

BEFORE THE

COMMITTEE ON ARMED SERVICES
UNITED STATES SENATE

ONE HUNDRED FOURTH CONGRESS

FIRST SESSION

ON

S. 1026

AUTHORIZING APPROPRIATIONS FOR FISCAL YEAR 1996 FOR MILITARY ACTIVITIES OF THE DEPARTMENT OF DEFENSE, FOR MILITARY CONSTRUCTION, AND FOR DEFENSE ACTIVITIES OF THE DEPARTMENT OF ENERGY, TO PRESCRIBE PERSONNEL STRENGTHS FOR SUCH FISCAL YEAR FOR THE ARMED FORCES, AND FOR OTHER PURPOSES

PART 7
STRATEGIC FORCES

MARCH 28; APRIL 25; MAY 2, 16, 18, 1995

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DEPARTMENT OF DEFENSE AUTHORIZATION FOR APPROPRIATIONS FOR FISCAL YEAR 1996 AND THE FUTURE YEARS DEFENSE PROGRAM

TUESDAY, MARCH 28, 1995

U.S. SENATE,
SUBCOMMITTEE ON STRATEGIC FORCES,
COMMITTEE ON ARMED SERVICES,
Washington, DC.

U.S. BALLISTIC MISSILE DEFENSE REQUIREMENTS AND PROGRAMS

The subcommittee met, pursuant to notice, at 9:43 a.m., in room SR–222, Russell Senate Office Building, Senator Trent Lott (chairman of the subcommittee) presiding.

Committee members present: Senators Lott, Thurmond, Exon, and Bryan.

Committee staff members present: Richard L. Reynard, staff director; George W. Lauffer, deputy staff director; and Christine K. Cimko, press secretary.

Professional staff members present: Romie L. Brownlee and Eric H. Thoemmes.

Minority staff member present: William E. Hoehn, Jr., professional staff member.

Staff assistants present: Pamela L. Farrell, Kathleen M. Paralusz, and Connie B. Rader.

Committee members' assistants present: Samuel D. Adcock, assistant to Senator Lott; Judith A. Ansley, assistant to Senator Warner; Richard F. Schwab assistant to Senator Coats; Thomas L. Lankford, assistant to Senator Smith; Andrew W. Johnson, assistant to Senator Exon; Richard W. Fieldhouse and David A. Lewis, assistants to Senator Levin; Steven A. Wolfe, assistant to Senator Kennedy; Donald A. Mitchell and John P. Stevens, assistants to Senator Glenn; William Owens, assistant to Senator Robb; and Randall A. Schieber, assistant to Senator Bryan.

OPENING STATEMENT OF SENATOR TRENT LOTT, CHAIRMAN

Senator LOTT. Thank you, gentlemen, for being here. I apologize for being a little tardy in getting started this morning.

I understand our ranking member, Senator Exon, will be here momentarily. He has been delayed at a Nebraska Society breakfast. And that is very important. He certainly has to stay for that full breakfast.

The Subcommittee on Strategic Forces meets today to receive testimony from the Navy and the Army on the U.S. ballistic missile defense requirements and programs. Both services are currently developing and testing the systems that will form the bedrock of America's future theater missile defense, TMD, architecture. Once deployed, these systems will fill a gap in America's defensive capabilities that has existed for far too long.

Since the Persian Gulf war, the need for effective theater missile defenses has become increasingly obvious. Without these capabilities, even relatively minor military powers will be able to inhibit and undermine America's ability to project power and maintain forward presence. As the threat has become more salient, it has also become obvious that no single system or TMD system can fulfill the entire range of requirements.

The Navy is well suited for the ballistic missile defense mission. With over $40 billion already spent on the Aegis infrastructure, it would be irresponsible not to take maximum advantage of this investment. A naval TMD system offers several unique attributes that make it particularly attractive: it would not depend on overseas bases or airlift to be deployed; it would avoid concerns over foreign sovereignty; and it would provide a missile defense umbrella over friendly forces attempting to gain control over a theater of operations.

While I strongly support the Navy Lower Tier Program, and am pleased that it is a core BMDO program, I must say that I do not understand the decision to delay the Upper Tier Program. In my view, we should proceed with both tiers simultaneously and aggressively. Once the Navy completes its cost and operational effectiveness assessment in October, it would seem to make sense to finalize operational requirements and system design and get on with the Upper Tier major acquisition program.

The Army's TMD program appears to be in good shape. With the THAAD program beginning flight testing this year, we are well on the way to acquiring a genuine wide-area defense system. Patriot PAC–3 also seems to be on track. The one area where I have real concerns is with the Corps Sam. The international teaming arrangement that is being developed seems to present more questions than answers at this time.

In addition to its role in the area of TMD, the Army brings decades of practical experience to bear on the problem of national missile defense. In a world where missile threats are becoming more numerous, sophisticated, and long-range, we will surely want to draw on this expertise.

The Army and the Navy are to be commended for the way they have begun to work together on TMD. In an era of tight budgets and never-ending roles and missions studies, this is quite an accomplishment. I was particularly pleased to hear the Chief of Naval Operations and the Army Chief of Staff testify that Army and Navy TMD programs are not competitors, but complementary efforts, each equally essential. I believe that the services have a lot to learn from one another in this area, and I urge them to continue with this cooperation.

I remain extremely concerned by the administration's apparent willingness to have TMD limitations incorporated into the ABM

Treaty. If we agree to performance limitations on TMD systems, we will be forced to forego promising TMD options, and our current programs will soon bump up against an artificial technological ceiling. Why we would allow an agreement that was designed to regulate the U.S.-Soviet Cold War relationship to limit our TMD options and growth potential is beyond my comprehension.

I would like to welcome this morning Vice Adm. T.J. Lopez, the Deputy CNO for Resources, Warfare Requirements and Assessments. Admiral Lopez is joined by Rear Adm. J.T. Hood, the Navy's Program Executive Officer for Theater Air Defense. And let me note that Rear Adm. Rodney Rempt, Director of Theater Air Defense, is also present, but not at the witness table.

I would also like to welcome Lt. Gen. Jay M. Garner, Commanding General, U.S. Army Space and Strategic Defense Command. General Garner is joined by Mr. A.Q. Oldacre, the Army's Deputy Program Executive Officer for Missile Defense.

Before recognizing our witnesses, let me yield to the Senator from Nevada, if he would like to make any opening statement of his own or on behalf of the minority ranking member who is on his way here from a Nebraska Society breakfast, I would be glad to do that.

Senator BRYAN. Mr. Chairman, I thank you. I have no opening statement to make. I would simply ask that the record be left open in the event that the minority ranking member does care to offer a statement, to make it part of the record.

Senator LOTT. That certainly will be done. Gentlemen, we are ready to begin with Admiral Lopez.

STATEMENT OF VICE ADM. THOMAS J. LOPEZ, USN, DEPUTY CHIEF OF NAVAL OPERATIONS FOR RESOURCES, WARFARE REQUIREMENTS AND ASSESSMENTS; ACCOMPANIED BY REAR ADM. J.T. HOOD, USN, PROGRAM EXECUTIVE OFFICER FOR THEATER AIR DEFENSE

Admiral LOPEZ. Mr. Chairman, thank you very much, particularly for inviting me here to address this session and to talk about the Navy's theater ballistic missile defense.

I am anxious, as General Garner is, to entertain the questions, so I will be brief.

The President's budget, which you are considering, relies upon a significant naval contribution to meet the difficult problem of ballistic missile defense. This contribution will come from one area particularly; the strength of naval forces; independence—that is, freedom from sovereignty issues; and forward positioning for early action; and of course we use systems that are on the cutting edge of modern technology.

We are excited about this challenging new mission of theater ballistic missile defense, and we bring a potentially robust capability to the table. We are anxious to get on with it.

The United States has an obligation to our forward-deployed and expeditionary elements of our Armed Forces to field a highly effective area and theater ballistic missile defense system.

The threat is real, and American lives will be at risk in any confrontation. Theater missile defense is an extraordinarily difficult challenge, and no single system, I believe, will do the job. A joint and synergistic approach is necessary. And of course, the one operational system we have today is Patriot.

Together with the Ballistic Missile Defense Office, BMDO, the Navy is developing a two-tier system. The first system, area defense, will have a capability to defend against the shorter ballistic missile for debarkation in ports, coastal airfields, and expeditionary forces as they go ashore.

I might comment, I do not see how we can go ashore if we do not have this system.

This is a first priority for us. If we did not have it, to repeat what I said, I think Marine and Army lives will be lost even before they begin to fight.

Second, to greatly improve coverage and achieve defense in-depth, we are developing a long-range theater-wide capability, which can enable defense of an entire region from only a few ships. The world's oceans permit forward positioning of ships to achieve an early ascent-phase intercept. This capability will free us from the need to provide significant terminal defense around every potential target.

Forward deploying a theater ballistic missile defense system aboard naval ships can provide substantial political and military advantages. We will be early and first on the scene. We will have operational flexibility. And we will be independent of foreign sovereignty. And last, we will ease the demand on airlift requirements in the opening days of a crisis.

The Navy intends to deploy our theater ballistic missile defense capability using our already-available Aegis cruisers and destroyers. The Navy system will be comprised of two existing major systems: the SPY–1 radar and Standard missile, and a supporting system for command and control that will utilize the Cooperative Engagement Capability, CEC.

The SPY–1 radar has already demonstrated the ability to track theater ballistic missiles in ranges in excess of 500 kilometers. Our Standard missile is based upon 30 years of continued design evolution. The SM–2 Block IV extended range Aegis missile has recently completed successful test firings at sea on the U.S.S. *Lake Erie.*

The missile will provide a common defense against sea-skimming cruise missiles, aircraft, and theater ballistic missiles.

For theater ballistic missile defense we would use a Lightweight Exo-Atmospheric Projectile, or LEAP. And this is a kinetic kill vehicle added to our standard Block IV missile, which will provide wide-range theater capability.

We have conducted two LEAP tests—the latest was this morning—to verify LEAP integration with Navy missiles, and ultimately demonstrate the exo-atmospheric kill of a ballistic missile target from a ship.

Our system, we believe, is treaty compliant. We know that the area system is treaty compliant. And the theater-wide system we are quite positive is going to be the same. However, it is currently under review.

We have accomplished a great deal already, and we have ambitious plans for the future. There is a sound technical basis for our system, and a solid Aegis infrastructure already in place.

The Navy theater ballistic missile system can be at sea by the end of this decade, and can fill our warfighting CINCs' requirements.

Thank you, sir. And I am ready for your questions.

[The prepared statement of Admiral Lopez follows:]

Prepared Statement by Vice Adm. Thomas J. Lopez, Deputy Chief of Naval Operations for Resources, Warfare Requirements and Assessments

Naval Theater Ballistic Missile Defense (Naval TBMD)

Mr. Chairman, distinguished members of the Senate Armed Services Strategic Subcommittee, thank you for this opportunity to appear before you to discuss the Department of the Navy's Theater Ballistic Missile Defense (TBMD) Program.

In my testimony today I will make three main points:

First, the threat from theater ballistic missiles is real. More and more countries have recognized the political power wielded by a long range weapon of terror, as displayed by Saddam Hussein during Desert Storm. In fact, greater than 15 countries have theater ballistic missiles (TBM) and more than 25 countries possess or are developing nuclear, chemical or biological weapons. An unmanned ballistic missile is much cheaper to obtain and maintain than a manned aircraft, making it much more attractive to cash-short, developing nations.

Second, Naval TBMD will be required in future conflicts to ensure the safe entry of our forces and to ensure the safe flow of follow-on reinforcements into overseas theaters. The actual vs. desired flow of forces into a theater are not equal, and hard choices will have to be made regarding what assets are brought into a theater first. If TBMD can be provided by ships at sea, this will greatly alleviate the critical demand for sealift and airlift in the early days of a crisis.

Third, and equally important, is the fact that we have already invested over $40 billion in Aegis ships, with their Spy radars, vertical launchers command and control capability, personnel, and the Standard Missiles which they employ. To not take advantage of this existing capability would be a disservice to the Nation. Navy TBMD can be fielded quickly and relatively cost-effectively.

To support these points in more detail, I provide the following testimony, which will address national concerns and solutions, Naval TBMD leverage, our accomplishments and plans, and a few remarks about the Anti-Ballistic Missile Treaty compliance of the Navy TBMD program.

NATIONAL CONCERNS

There are a number of concerns with respect to the proliferation threat of ballistic missiles, potentially delivering weapons of mass destruction. Primary United States' strategic objectives include deterring conflict in the first place, or rapidly stopping the war once it begins. In the case of tactical ballistic missiles the United States is committed to defending forward deployed and expeditionary elements of our own Armed Forces and to support the defense of friendly forces and allies. Specific concerns include:

— Protection of U.S. forces already deployed in a crisis area.

— The means to provide engagement of TBMs with high confidence through defense in depth in order to reassure threatened coalition allies.

— Reinforcement of deployed forces through protected debarkation ports, airfields and staging areas.

— Reduction in early demand for airlift and sealift.

THEATER THREAT

For example, in the Western Pacific theater, more than 80,000 U.S. active duty personnel (including 20,000 marines and 15,000 sailors) are at risk of attack from TBMs today. The supply depots, repair facilities, support organizations and military families in the area are also at risk. While the majority of the threat TBMs are the shorter range (100–600 KM) Scud variants, several longer range (600–1200 KM) No-Dong and (1000–3500 KM) Taepo Dong missiles are in various stages of development. The threat is real; American lives are at risk.

NATIONAL SOLUTIONS

Theater Missile Defense (TMD) is an extremely difficult challenge. No one system will do the job. A joint "system of systems" synergistic approach is necessary. Today, the Nation's existing TBM defense capability rests with the Patriot System and its evolving improvements. This system has proven terminal defense capabilities against the relatively shorter range TBMs which spend most of their flight time within the atmosphere. The Navy and the Ballistic Missile Defense Organization (BMDO) are also developing a similar capability to provide area defense of debarkation ports, coastal airfields, amphibious objective areas and U.S. expeditionary forces as they go ashore.

To improve area coverage and achieve a two tier, layered terminal defense, the BMDO is developing a Theater High Altitude Area Defense (THAAD) interceptor together with a Theater Missile Defense-Ground Based Radar (TMD–GBR). For the Navy, BMDO is developing an even longer range Theater Wide capability which would enable defense of entire regions (the eastern Mediterranean, the western Pacific) from a few strategically placed ships. Positioning long range TBM defenses at sea provides dramatic deterrent and war winning leverage. Because of the ability to reposition ships closer to the launch point of the TBM, the same radar capability and TBM interceptor performance that provides tens of thousands of square kilometers of terminal defense ashore, provides hundreds of thousands of square kilometers of defended area if positioned at sea closer to the country that is threatening to fire these TBMs. The world's oceans permit this forward positioning at sea, enabling the Navy to achieve an early ascent phase intercept in just the areas we are most likely to need it; e.g., the Sea of Japan, the Arabian Gulf and the Mediterranean. This frees us from the need to provide terminal defenses around every potential target we wish to protect.

NAVY TBMD COVERAGE

Forward deploying TBMD aboard naval ships provides substantial political and military leverage. Naval forces are mobile they can arrive on the scene early and sustain themselves for days. In fact, in most cases, naval forces will be first on scene when a crisis is imminent. They provide great operational flexibility, especially as the United States continues to withdraw from overseas bases. Naval ships project a positive and engaged U.S. image to reassure friends and encourage regional stability. They are relatively independent of host nation support and can immediately influence political events. A single Aegis cruiser with Theater Wide TBMD capability on station in the Sea of Japan, would do much to ease the continuing concern over potential nuclear weapons and long range TBM development programs on going in the region. In addition to deterring the use of weapons of mass destruction and reassuring allies, TBMD equipped naval forces would buy time for negotiation and promote the cohesion essential to allied coalitions. Employment of TBMD from naval ships would be independent of foreign sovereignty, free from reliance on overseas bases, and would dramatically ease the demand for airlift in the opening days of a crisis . . . a resource which is in critically short supply.

DEPLOYMENT

Our experience in Desert Shield is a good indicator as to how TBMD forces might arrive in theater during a crisis. After an alert order, the first Patriot battalion completed airlift to Saudi Arabia in 34 days, while the second battalion was in place on day 82, having come primarily by sealift. The two Patriot Fire Units that deployed from Germany to Israel in 48 hours required more than 50 C–5As and diverted over 120 sorties each day from other high priority lift requirements. The extensive airlift/sealift requirements for land-based air defenses has been the subject of recent comments by both the Secretary of Defense and General Hoar, CINCCENT. Secretary of Defense noted the requirement for "an enormous amount of airlift at a time when we would want to be using it for other purposes . . . they (Patriot batteries) would consume 80–90 C–5As." Likewise General Hoar stated in testimony before the SASC in March 1994, "Strategic lift in this country is broken right now. Lack of adequate airlift could be a show stopper in the next war."

On the other hand, naval forces provide the means to bring initial TBMD capability into a theater in a few days (if not already on station), and substantial forces within 10 days or more. This greatly eases the demand on airlift and sealift to bring in forces early to protect the very ports and airfields at which reinforcements would debark. It enables the CINC to concentrate available lift on anti-armor, tactical aviation support, tanks, troops, ammunition and other reinforcements he needs to stop the enemy advance.

OPERATIONAL FLEXIBILITY

Naval forces with TBMD provide significant flexibility to the theater commander. From a few stations in the Sea of Japan, three or four Aegis destroyers and two or three Aegis cruisers can provide a highly survivable TBMD force covering most

U.S. forces in the Republic of Korea (ROK) and Japan. These ships can be visible or unobtrusive, are self sustaining, and carry out traditional naval missions such as protection of air and sealift, air intercept control, Tomahawk cruise missile strikes, shore bombardment, submarine neutralization and maritime interdiction, while simultaneously providing TBM defense. We intend to deploy TBMD capability using our existing and planned Aegis fleet of cruisers and destroyers.

DETECTION

Existing Spy radars, operating aboard our highly capable Aegis ships in the Sea of Japan and using software presently undergoing land based testing, can provide thorough surveillance, detection and tracking of all TBMs launched in a region. At the same time, they can detect, track and identify aircraft and cruise missiles entering their surveillance areas. The Aegis Spy system has repeatedly demonstrated the ability to track TBMs at ranges well in excess of 500 KM during testing off Wallops Island and Cape Canaveral in the Atlantic, and off Kwajalein and Wake Island in the Pacific. In addition, several Aegis ships actually tracked Scuds fired during Desert Storm, but did not have an engagement capability at the time. Surveillance for TBMs does not depend on space based or other external cueing, but like land based systems, detection and engagement performance would be enhanced against longer range TBMs if a timely, accurate cue was available. Fully functional Spy radar computer programs will be proven in full scale tests at sea this coming summer.

ENGAGEMENT

The Standard Missile to be employed for TBMD is based on 30 years of continuing design evolution. The SM–2 Block IV Extended Range Aegis Missile (Aegis-ER) has recently completed successful developmental and operational tests (DT/OT) at sea aboard U.S.S. *Lake Erie* (CG–70). This very long range, high Mach missile contains a proven booster, rocket motor and missile control system, which, when combined with guidance and warhead improvements, will provide a common missile for use against sea-skimming cruise missiles, aircraft, and TBMs within the atmosphere. This same proven missile will be modified with a Lightweight Exo-Atmospheric Projectile (LEAP) or THAAD developed hit-to-kill vehicle to provide a very long range Theater Wide capability. The use of the existing Aegis-ER missile minimizes the weapon system interface and launcher design modifications necessary to deploy this new capability aboard ship.

BATTLE MANAGEMENT/COMMAND, CONTROL, COMMUNICATIONS (BM/C3)

The Navy has already deployed the command and control systems necessary to conduct TBMD, and has extensive experience in coordinating Theater Wide air defense using widely dispersed forces. The ongoing rapid installation of satellite communications, experience with the Joint Tactical Information Distribution System (JTIDS) currently being deployed, the real time use of Tactical Related Applications/Tactical Receive Equipment (TRAP/TRE) reports and other vital intelligence information, and the deployment of Naval Tactical Command Systems-Afloat (NTCS–A) makes the Navy fully ready for the TBMD role. Most importantly, the Navy is concurrently developing the Cooperative Engagement Capability (CEC) which nets the sensor information from dispersed units into fire control quality composite tracks. This war leveraging technique promises to greatly extend detection ranges, improve track continuity, develop a force wide cumulative ID, increase depth of fire and time to engage, and dramatically improve real time force coordination in order to reduce magazine expenditures. This system completed highly successful at sea tests and live missile firings against cruise missiles last summer, and demonstrated composite tracking of TBMs during the USACOM-directed Joint Task Force (JTF)–95 TMD exercise in August 1994. In February 1995, the Eisenhower Battlegroup conducted an impressive connectivity demonstration in which 26 CEC-generated synthetic TBM tracks entered by Aegis ships located in the Adriatic Sea were passed in near real time via multiple means to Patriot batteries about 800 miles away in Kaiserlautern, Germany.

TECHNICAL MATURITY

The Aegis ships with their Spy radars, vertical launchers, integrated battle management, robust communications, and experienced officers and sailors are operating at sea today. Spy radar computer programs and Aegis weapon control system software modifications for TBMD are undergoing land based tests, leading to tests at sea in mid-1995. The Standard Missile 2 Block IV has completed Developmental

Testing/Operational Testing (DT/OT) and will shortly begin Low Rate Initial Production (LRIP). Modifications to this missile for the Area TBMD capability have been designed and are undergoing preparation for test firings at White Sands Missile Range later this year.

The LEAP program is based on a more than $400 million investment by SDIO/BMDO to build hit-to-kill vehicles sized for tactical missiles. The Navy is in the process of conducting LEAP experiments from a Terrier missile ship at sea to verify LEAP integration with the Standard Missile and demonstrate the exoatmospheric kill of a TBM target from a ship. Early results verify compatibility of the LEAP vehicle and standard missile, including proper staging, separation, acquisition and guidance on exoatmosphere targets. Future tests will verify hit-to-kill capability of the projectile. Full scale development would then involve producing the LEAP vehicle, integrating it with the Aegis-ER Missile, and providing for its proper initialization by the Aegis, weapon system.

INVESTMENT LEVERAGE

The Nation has already invested over $40 billion in more than 50 Aegis cruisers and destroyers with over 5,000 vertical launch cells. These ships will require no additional manning and already have the complete training/logistics/ammunition infrastructure in place and operating. Our Aegis ships have proven cruise missile defense capability, as well as Tomahawk strike, anti-submarine warfare, LAMPS helicopters and other multi-mission capabilities. More than $5 billion has been invested in relevant development and installation of battle management and communication capabilities and over $1 billion in development of the Standard missile family. As a result, a relatively small further investment can enable a substantial near term payoff. By adding this projectile to systems already programmed, the Nation could obtain more than 50 cruisers and destroyers with 1,500 missiles for Area TBMD, and as many as 22 cruisers with 650 missiles for Theater Wide capability. Further, the Japan Maritime Self Defense Force is indicating growing interest in equipping their existing (two in commission, two more building) and planned (2–4 more) Aegis destroyers with Theater Wide capability for the defense of Japan. Several NATO countries (United Kingdom, Germany, The Netherlands, Italy and France) have indicated keen interest in joining with the U.S. Navy in developing TBMD capability at sea.

TMD PRIORITIZATION

The Bottom-Up Review (BUR) of September 1993 identified Patriot, THAAD/GBR and Navy Area TBMD as part of the core TMD program. Further, it changed the Sea Based (Upper Tier) Theater Wide capability from a technology demonstration to a major acquisition program. It directed examination of the feasibility of ascent/boost phase intercept and delayed major work on CORPSAM until fiscal year 1998. Subsequently, the reduction of the BMDO budget from $18 billion to $17 billion over the FYDP, resulted in reducing the Sea Based (Upper Tier) Theater Wide program to studies and analyses only. Thus, the Navy Theater Wide capability, identified as a major acquisition objective in the BUR, has been essentially unfunded, despite its potentially significant political and military leverage.

Subsequently, the Joint Staff reaffirmed the prioritization of TMD programs as established by the BUR. Additionally, the Chief of Naval Operations and the Commandant of the Marine Corps jointly declared that the primary focus of the naval TBMD effort was to field an Area TBMD capability as quickly as possible to preserve our ability for forcible entry overseas. Currently, the Department of Defense is conducting a TMD Capstone Cost and Operational Effectiveness Analysis (COEA) to determine the appropriate mix and number of TMD systems to develop and acquire.

The Navy believes that the BUR's finding that two-tiered TBM defenses, both land-based (Patriot and THAAD/GBR) and sea-based (Navy Area and Theater Wide), are essential to the successful defense of our forces and allies, and will be reinforced by the results of the COEA. Additionally, it should provide a better feel for the force levels required of each system.

TREATY COMPLIANCE

The Navy Area TBMD capability has been certified to the Congress as fully treaty compliant. The Navy Theater Wide capability has also been analyzed and we believe it will be found treaty compliant. Completion of the formal certification process by the Department of Defense is pending. In employing the planned Theater Wide system, if an Aegis ship is in place to detect a rising strategic ballistic missile (ICBM), it cannot determine an intercept point or initialize a theater wide interceptor until the ICBM has completed boost acceleration. Moreover, the ICBM speed of 6–7 KM/Sec easily outdistances the 4–5 KM/Sec speed of the LEAP interceptor, precluding an ascent phase intercept. If an Aegis ship is near the terminal target of the ICBM, the radar waveforms and signal processor are unable to detect the small, high speed reentry vehicles (RVs) until they decelerate in the atmosphere. At that point, the RVs are below the minimum altitude of the exoatmospheric hit-to-kill vehicle.

RECENT ACCOMPLISHMENTS AND PLANNED EVENTS

The Navy has accomplished a great deal in the past year in our joint efforts with BMDO to rapidly field a Naval TBMD capability:

— The U.S.S. *Port Royal* (CG–73), the last Aegis cruiser, and four Arleigh Burke destroyers were commissioned, adding nearly 500 vertical launch cells to the fleet.

— The U.S.S *Carl Vinson* Battlegroup deployed with a full JTIDS data link capability.

— The Naval TBMD program was reviewed by the Defense Acquisition Board (DAB) and both Navy and Capstone TMD COEAs were initiated.

— The U.S.S. *Kitty Hawk* Battlegroup conducted a successful TBMD exercise in the Western Pacific and *Eisenhower* and her CEC equipped ships demonstrated composite tracking of TBM targets in the Atlantic.

— The Marine Corps successfully engaged short range TBM targets with modified Hawk missiles.

Our plans for next year are just as ambitious:

— Completion of the Terrier LEAP experiments from the cruiser *Richmond K. Turner.*

— Initiation of low rate initial production of the SM–2 Block IV Missile.

— At sea testing of Aegis Spy radar tracking and satellite cueing to prove fully functional computer programs.

— Lethality simulations and full scale tests.

— Live firings of the SM–2 Block IV missile with the added Infrared seeker at White Sands Missile Range.

— Completion of the Navy COEA and preparations for a Milestone review by the DAB.

— Commissioning of five more Arleigh Burke Aegis destroyers.

CONCLUSION

The United States urgently requires Naval TBMD. There is no other way to provide defense against the growing TBM threat if we are expected to seize landing areas ashore and secure debarkation ports and coastal airfields in the crucial, initial stages of a crisis. We must ensure a forcible entry capability against today's threat.

Because there is a sound technical basis for the development plan and a solid Aegis infrastructure in place, Naval TBMD can be at sea by the end of the decade. The evolutionary development of Naval TBMD builds on the very successful Aegis and Standard Missile engineering legacy.

The Naval TBMD plan meets national concerns and provides the maximum capability for the least amount of dollars. The Navy is working hard to rapidly complete critical system demonstrations in order to move out immediately with a full scale development program.

Senator LOTT. Thank you, Admiral Lopez.

Admiral Hood, do you have a statement at this time?

Admiral HOOD. No. Thank you, Mr. Chairman. I have no statement. I would be pleased to join Admiral Lopez in answering your questions.

Senator LOTT. Fine. Thank you. General Garner.

STATEMENT OF LT. GEN. JAY M. GARNER, USA, COMMANDING GENERAL, U.S. ARMY SPACE AND STRATEGIC DEFENSE COMMAND

General GARNER. I have a short statement. I want to thank you and the committee for the opportunity to appear and discuss the Army's missile defense program.

As you pointed out, I am joined today by Mr. A.Q. Oldacre, who is the Army's Deputy Program Executive Officer for Missile Defense. Mr. Oldacre and I represent both the user and the development used for the Army for missile defense. We welcome the opportunity to share our views and discuss missile defense with you.

I will make just a couple of points. The proliferation of ballistic missile and technologies to hostile Third World countries with a willingness to use them makes missile defense more important now than it has ever been.

We have made great strides, both the Army and the Navy, in theater missile defense, except at the very lower end of the spectrum, in the Army, for the very short-range missiles that jeopardize the maneuver of U.S. Army and U.S. Marine forces.

And finally, what has gotten this Nation into its premier position in missile defense has been our technology. But because of funding cutbacks, they will reduce our ability to develop technologies for the next generation. So that is somewhat of concern to us.

Again, I thank you for the opportunity to appear before you. I would be happy to answer any of your questions.

[The prepared statement of General Garner follows:]

PREPARED STATEMENT BY LT. GEN. JAY GARNER, COMMANDING GENERAL, U.S. ARMY SPACE AND STRATEGIC DEFENSE COMMAND

Thank you, Mr. Chairman and members of the committee, for the opportunity to appear at this hearing to discuss the Army's missile defense program. As Commander, U.S. Army Space and Strategic Defense Command, I have the distinct privilege of directing the activities of: U.S. Army Space Command, Colorado Springs, CO, the Army User for National Missile Defense; Missile Defense and Space Technology Center, Huntsville, AL, the Army's development center for Missile Defense technologies; and Kwajalein Missile Range, the Nation's only full service test range for Ballistic Missile Defense systems. I am joined today by Mr. A.Q. Oldacre, the Army's Deputy Program Executive Officer for Missile Defense. Mr. Oldacre's organization develops Theater Missile Defense systems such as THAAD, the currently fielded Patriot and its upgrades, as well as Army National Missile Defense systems. Together, PEO–MD and I share a uniquely comprehensive view of the Army's roles and responsibilities in Missile Defense. We welcome this opportunity to share our views with you and hope you will find them useful.

The proliferation of nuclear, biological, chemical, and ballistic missile technologies to hostile Third World countries with the willingness to use them, makes missile defense more important now than ever. From the Army's standpoint, we would like to make three points about missile defense. First, we have made great strides in the area of Theater Missile Defense, except at the lower end of the spectrum against an evolving array of very short range missiles and cruise missiles. These missiles can be made cheaply and can form an effective "poor man's Air Force" for Third World nations and pose an ever increasing threat to our maneuver forces. Second, in the area of national missile defense, we have the resident technology to provide a contingency capability to be employed during times of crisis, should the Nation decide.

Finally, what has gotten this Nation to its premier position in missile defense has been our technology. But continued funding cutbacks will reduce our ability to develop technologies for the next generation of missile defense systems. Consequently, if this trend continues, we will not enjoy a premier position in missile defense in the 21st century.

Again, thank you for this opportunity to appear before you. We will be happy to answer any questions you might have.

Senator LOTT. Mr. Oldacre, would you like to make a statement at this point?

Mr. OLDACRE. No, sir, no opening statement. I will join General Garner in answering the questions.

Senator LOTT. All right.

Well, we are not going to, I think, have an abuse of this, but we will try to limit the questioning to 7 minutes, and then we will go back and forth. I am sure we are going to have others join in here later on. [Laughter.]

Admiral Lopez, how does Navy TMD complement other missile defense elements? Do you believe that we are creating too much of an overlap between land-based and sea-based systems?

Admiral LOPEZ. No, sir, I do not believe—to answer the last part of your question—that we are creating too much overlap. I do not think any warfighter could ever have too much overlap. One of the basic principles of warfighting is defense in-depth. And if you had a lower tier system, which had a shot at a particular missile, and out beyond that was an upper tier system, that would give you a shot before it even reached the point defense systems. And I think that is the direction we ought to go.

An example I could give you would be in the sense of a scenario like Korea, launching a missile against a country like Japan, where you had Aegis sitting out in the Sea of Japan. If we could launch against a missile flying toward Japan in a theater missile defense scenario, perhaps we knock down two or three of those, and one or two you miss. They could be cued, if you will, to the Patriot via CEC. So that gives you overlap and defense in-depth, as well as cueing.

So I think that defense in-depth is absolutely key. I think overlap is key. Because the theater ballistic missile defense is a very tough problem.

Senator LOTT. Admiral, are there not compelling requirements for both the Navy lower tier and upper tier?

Admiral LOPEZ. Yes, sir, I think there are compelling requirements for both, as I addressed in my oral statement. In area defense, I frankly believe that we will not be able to get ashore in a future war unless we are able to destroy incoming missiles.

That is for a forced entry, for example. And even post-entry, after you are there, you have to be able to protect your ports of entry; otherwise, sustainment and follow-up supplies will not get there. And we do not want our people being killed or wounded, frankly, before they are even able to fight.

In upper tier, as I have discussed earlier in your previous question, it will give us defense in-depth and, frankly, give us wide-area coverage with only a few ships. And this seems to be the most cost-effective solution, to have both upper tier and lower tier reinforcing each other.

Senator LOTT. The Bottom-Up Review recommended proceeding with the Navy upper tier at the same time as BMDO's core TMD programs. Why was the Navy upper tier slipped into the follow-on category, with no major acquisition decision until 1998?

Admiral LOPEZ. Well, sir, I think it was an affordability decision for the Department of Defense. There was, as I recall, about $1 billion cut out of the BMDO budget; and they chose to take the majority of that out of Navy upper tier.

We believe, even despite those cuts, we are very close to having an upper tier capability. We have taken some very bold steps—bold experiments, I would term them—with our two tests of upper tier, and have achieved the majority of our expectations.

I think if we can find the funding within our own resources or elsewhere, then we will be able to move out smartly on upper tier.

Senator LOTT. Admiral Hood, given the funding that you have for fiscal year 1995—$75 million I think it is—and assuming an acquisition decision as soon as the cost and operational effectiveness assessment is complete, when would the Navy upper tier system become operational, and how much would this cost?

Admiral HOOD. Given the state of the program right now, we could have an initial capability, I believe, with an all-out effort, in about 4 years. That would take about in the neighborhood of $170 million, on top of——

Senator LOTT. One hundred and seventy million dollars?

Admiral HOOD. One hundred and seventy million dollars in fiscal year 1996, on top of the $30 million that is in the budget right now. I am speaking of a rather aggressive program here.

The cost over the FYDP would be in the neighborhood of $2 billion; the estimated total program cost, including 650 missiles, is about $3.5 billion. That is the program that was removed from the BUR that Admiral Lopez referred to.

Senator LOTT. I understand, Admiral Hood, that the compliance review group has completed its review of the Navy upper tier program. Is that true? What is the status of that report?

Admiral HOOD. As Admiral Lopez just said, that is still under review within the Pentagon. We believe that it will be found to be treaty compliant.

Senator LOTT. It finds the upper tier program treaty compliant?

Admiral HOOD. The upper tier, we believe that it will be found to be treaty compliant. We are optimistic that the review will show that.

Senator LOTT. General Garner, you were recently quoted in Defense News as saying that the threat does not warrant deployment of a national missile defense system in the near future. When would you recommend establishing an initial NMD capability?

General GARNER. Well, I am not sure that is exactly what I said. But if I did say that, that is not the way the I meant to frame my remark.

Senator LOTT. All right.

General GARNER. What I thought I said was that there are two scenarios that I think we have to consider. The first scenario is one of accidental launch. And we have always faced that threat. It has not happened yet. But because of the turbulence in the former Soviet Union, there may be some increased risk there now. I am not sure that there is, but that is one scenario.

The second one is a scenario of a rogue nation obtaining an ICBM capability. I think the intent is there. Saddam Hussein said if he had missiles that he could strike Washington, he would do so. Muammar Qaddafi said that given missiles of that capability, he would strike New York. And Abbas, the PFL leader, said if not my son, then the son of my son will have a missile that can strike New York. So certainly the intent to do that is there.

The question is, is the technology there?

There are a lot of ways you can get the technology. If you can go buy a system, then you can have instant capability. But if you cannot buy one, then the availability of both components and technology has dramatically shortened the time lines it would take to develop an ICBM.

Now, let me be clear about that. It is difficult for any country to develop an ICBM. But the technology is detailed in open literature. And you can read about it in open literature. Also, much of the hardware is available on the open market that you could go and buy.

So once you have TBM technology, then to take the next step to ICBM is much easier. For example, it took us 17 years in this country to build surface-to-surface missile systems that would range from 100 kilometers to 300 kilometers. But once we worked those problems out—and that was out in open literature—it took the North Koreans only 4 years to build a system to go from 300 kilometers to 1,000 kilometers. And today, we are projecting that they have a Taepodong that will go around 5,000 kilometers.

So the availability of component and knowledge has shortened the time line. The question is, how short are the time lines?

So the second question is, would we as a Nation have adequate warning in such time that we could field an NMD system?

Certainly, if another country is developing or testing an ICBM system, that is observable to us. We will know that. The transfer of an entire weapon system is a little bit more difficult to detect. The transfer of components and technology is almost impossible to detect if you do not want us to detect it. And, again, advanced warning is going to vary by region and where it is occurring.

So there can be an endless debate on whether or not there is a threat. I guess it comes down to the question, do you want to deploy an NMD system in this country as an insurance policy against the vagaries of our knowledge of the threat? And that is the question that has to be answered.

To the services, let me add, the question is, who is going to be the bill payer? Because all of us are in a time of resource constraints, and NMD is an expensive program.

So I cannot answer the question of whether or not the threat is there. It is in the mind of the beholder. I think it comes down to, is the amount of money it would take to field that system worth it as an insurance policy to our Nation?

Senator LOTT. Well, in that connection, General, I understand that the Army is recommending an NMD program that would produce a limited contingency capability in fiscal year 1998, and deployment of 20 ground-based interceptors in fiscal year 1999. This program requires the Army NMD budget to be $650 million in fiscal year 1996, and would cost a total of $3.4 billion.

Are these numbers correct, and do you support this program?

General GARNER. What we have done, sir, is offer a program to BMDO that we have recommended should the funds be made available to deploy an NMD system, and should the Nation decide to go forth with such a deployment.

Given a decision in 1995 and the dollars allocated in 1996, what we could do is produce a limited operational capability—and I call limited operational anywhere from four to eight interceptors—by the end of 1997; and then initial operational capability by the end of 1999. That would give the Nation 20 interceptors, plus a ground-based radar, plus a radar technology demonstration at Kwajalein, where we would do the testing.

It would be roughly a $600 million a year plus-up to the current program. It will cost about $3.7 billion to do that, to the Army, of which we already have almost $1 billion. So it is around a $2.8 billion plus-up to the current Army program.

That is just dollars to the Army. I think it would probably cost a little more than $1 billion, in addition to what you gave the Army, in order to do the BMC3 piece for NORAD and also to do the communication tie-ins to the early warning radars, so that you could get a more detailed message format for vectoring missiles.

So, all in all, somewhere in the neighborhood of $5 billion between now and 1999, or from 1996 to 1999.

Senator LOTT. General, given that the Army has major acquisition programs for lower tier and upper tier ballistic missile defense—for instance, the Patriot PAC–3 and the THAAD—do you support the Navy lower tier and upper tier programs? Are these programs mutually reinforcing or excessively redundant in your opinion?

General GARNER. They are not redundant. I do not think you can have enough people in the theater missile defense business, because we are talking about weapons—potentially talking about weapons of mass destruction.

The Navy lower tier is mandatory because many of the scenarios you see us operating under in the future begin in the littorals. And until we can have a lodgement inland, to where we can bring in our ground-based systems, we have to have protection from the Navy. So, sea-based is necessary until we achieve lodgement.

The other part of that is Navy upper tier. The advantage Navy upper tier brings to you is not only the wide area that Admiral Lopez talked about, but it gives you, in many scenarios, the capability to get an asset shot on a launched missile.

An example would be a missile launched from Iran into Saudi Arabia, Iraq into Iran, missiles launched down the Peninsula of Korea, where you could steam up in the northern part of North Korea and get ascent shots; or missiles launched from Korea to Japan; or missiles launched from Libya into Europe. And I think that is important.

What you cannot do, I think, is trade off one against the other, because we have complementary capabilities. And if you trade off one against the other, then you have created a hole in our defense.

So, yes, sir, I think the Army is a strong supporter of both Navy lower tier and Navy upper tier. And I think you can see that the cooperative work between the Army and Navy that we have begun to do demonstrates just that.

Senator LOTT. General, in fiscal year 1996, BMDO is allocating approximately, as I understand it, 80 percent of its budget to TMD, 15 percent to NMD, and 5 percent to advanced technology. Do you believe this allocation is about right, or would you change it? And if the BMDO budget should be increased, how would you recommend that such funds be allocated?

General GARNER. Sir, I think at the current funding levels, it reflects the priorities that have been set out for us. But we still have shortfalls in TMD. In the Army, we need to get a Corps Sam system started in order to provide the requisite protection against the short-range theater ballistic missiles and cruise missiles for our maneuver forces—Army and Marine Corps maneuver forces.

There is about a $60 million shortfall in THAAD. It came from an undistributed cut in 1995 that has shortened our UOES system from 1997, to put that off until 1998.

Navy upper tier, for the most part, is unfunded.

The technology has been reduced 76 percent in the last 4 years. For example, follow-on technologies, which are very important to us, are down by 90 percent over the last 4 years.

Analysis and simulation, which is really the heart of the things that we do, is down by 70 percent.

Phenomenology work is down by 40 percent.

Now, NMD is about right, unless you want to deploy a system. If we go to deploy a system, then we are about $500 million a year short.

Senator LOTT. Mr. Oldacre, let me address a couple of questions to you if I could, and that will get you in this mix.

BMDO has developed a near-term deployment plan for NMD that in many ways resembles what the Army has proposed. What are the key differences and similarities between these two approaches as you see it?

Mr. OLDACRE. Well, I think there are a lot of similarities between the two. Primarily, the difference between what we would do and what they would do concerns the use of the Minuteman III as the booster for the program and the use of GBR radar as the fire control radar for the site at Grand Forks. Our use of treaty-compliant boosters and use of the GBR avoids treaty issues and allows full testing. Those are some of the primary differences between our approach and theirs.

Long term, I think we want to end up at the same objective. The Army has recommended acceleration along the path to the objective system as the fastest way to get to a contingency capability.

Senator LOTT. Has anything been done, or is there anything being planned to reduce the performance capabilities of THAAD as a result of the ABM Treaty?

Mr. OLDACRE. The thing that we have had to do to the UOES system is to limit our capability to accept external cueing from sources like DSP, for example. This has been interpreted by the CRG to be a possible conflict with the treaty.

So, for the UOES system, we have not developed that software module what would allow us to accept an external cue for the system, which would, in turn, allow the radar to see the target out further, to increase the battle space, and to take perhaps an extra shot or an earlier shot at the target. So that is the primary thing.

Senator LOTT. That has been delayed?

Mr. OLDACRE. That particular software module is not being built in the UOES system. So it will simply not have that capability.

Now, we can demonstrate what we need to demonstrate to build the UOES system and to demonstrate the internal THAAD capabilities. But for the objective system, we would certainly want to incorporate that cueing capability. So we would hope that that particular constraint, as we move downstream, would be removed.

Senator LOTT. Mr. Oldacre, could a treaty-compliant NMD system defend the entire United States from a limited ICBM attack?

And against how many missiles could such a system defend? And would Alaska and Hawaii be defended?

Mr. OLDACRE. A treaty-compliant system can give us coverage against a few interceptors that would attack the CONUS, and we could provide some coverage to Alaska. For Hawaii, there are different ways of attacking that problem. But this system would not cover that.

Senator LOTT. Do you want to add anything to that, General Garner?

General GARNER. Yes, sir. I would say that we can provide—according to where the missile is launched from, we can provide good coverage of the 48 contiguous States. We can provide limited coverage of Alaska. And again, like Mr. Oldacre said, there is a way to protect Hawaii, but you cannot discuss it in this forum.

With only 20 interceptors, then the number of incoming vehicles that you could attack really becomes a function of where they are aimed at and how good your battlefield geometries are in attacking those incoming missiles.

For some incoming missiles, it takes multiple shots. Others it just takes a single shot. So it is scenario-dependent.

Senator LOTT. Let me go back to you, Admiral Lopez. What role will the Navy's Cooperative Engagement Capability, CEC, play in ballistic missile defense? And what has been done and what is planned to demonstrate this capability, both within the Navy and between the services?

Admiral LOPEZ. Well, there are a couple of things, sir. One that comes to mind first with respect to CEC is it is a leveraging capability that you can cue other systems; whereas other systems would be ships or those other systems would be Patriot batteries.

We have done both and have been very highly successful in a cruise missile shoot-down, which we demonstrated for the Secretary of Defense down in the Caribbean last year, where our hit ratio was far higher because of CEC than we had ever had before.

We recently—in fact, just last month—linked with a Patriot battery in Germany from the Adriatic successfully, using IMMARSAT. That is not how we would do it in a wartime scenario, but we wanted to see if we could; and we did, by generating computer targets. And it worked very well.

CEC, in my sense, would not only increase the detection range, because if you are properly cued, you are pointing in the right direction, it will effectively widen our area in theater coverage.

We think the Navy has the best radar, the Aegis SPY–1, and our Army Patriot is the best missile, and CEC is the link between them.

Senator LOTT. General Garner, is there any way we can reduce the cost of fielding the TMD systems that you could put on the record?

General GARNER. Sir, we think there is. We think that through a very robust analysis and simulation program that we can drive the cost down. One way to do that is to test the concepts and the technologies in simulations and analysis before you begin spending a lot of your research and development dollars.

Toward that end, we have opened a Battle Integration Center in Huntsville, Alabama, to do robust testing of theater missile defense systems. Through DIS, we have connected that with the Air Force. We are now in the midst of connecting that with the Navy. We have also connected up with all of our battle labs.

Another way to do it is to reduce testing through simulations. And then, finally, to stabilize funding certainly helps reduce costs.

Senator LOTT. We hope to help you with that, too.

Admiral Lopez and General Garner, were each of your respective services consulted regarding the issue of placing speed limits on our interceptors? Admiral Lopez.

Admiral LOPEZ. Were we consulted, sir?

Senator LOTT. Yes.

Admiral LOPEZ. We were asked what those limitations would do to our ability to get on with the program. As you know, limitations in the interceptors will narrow the footprint, if you will. Our upper tier that we have—or our concept of operations—would require us to have an interceptor of perhaps 4.5 kilometers per second.

If you narrowed that down to 3 kilometers a second, then you can expect your coverage of crossing targets or the way you can look and intercept to be considerably narrowed. So we advised JCS that that would be the effect.

Senator LOTT. So you told them that it would be significantly limiting in your capabilities, right?

Admiral LOPEZ. Yes, sir. We have said that any decrease in intercept speed will significantly limit our ability to intercept.

Senator LOTT. What about you, General?

General GARNER. We were consulted. We did not concur with limiting the velocities because of the decrease in the battle space in which you need to work those tight time lines, number one. And then, number two, because it limits us with any future potential threats. So we were against lowering the speed limit on incoming interceptors.

Senator LOTT. Well, thank you all for your responses to my questions.

Now, I will be delighted to yield to our distinguished Chairman, the uppermost tier of generals, Strom Thurmond.

Chairman THURMOND. Thank you very much, Mr. Chairman. You are such an able chairman of the subcommittee here that I do not think I have any special questions that you have not asked.

I just want to commend you gentlemen for your service to your country. I often think about people in uniform, who are pulled into different parts of the world, subject to be transferred from one place to another, quickly, away from their families. You deserve great credit, and I just want to commend you. Thank you.

General GARNER. Thank you, sir.

Chairman THURMOND. Thank you, Mr. Chairman.

Senator LOTT. Thank you, Mr. Chairman.

Admiral Lopez, can you update us on the LEAP tests that have been conducted recently?

Admiral LOPEZ. Yes, sir. We have conducted two tests in the last couple of months, the latest one was this morning. Let me give you an overall look at those, and then I will turn to Admiral Hood for any of the technical issues.

Succinctly, the first test we had a considerable success, in my view. Probably, without equivocation, 95 percent of what we expected was there. We had a software problem in which our missile flew to the wrong spot. However, the LEAP vehicle locked on the target and pointed to the target. It simply ran out of gas, if you will, before it could get there. We corrected that error.

This morning's shot—this is the latest one—everything flew perfectly. The LEAP apparently locked onto the target, and then, at breakaway from the last boost, it failed to ignite—and maybe Admiral Hood can talk a little more about that—but then was not propelled toward the target.

So we think we are there, in the sense that we have gotten a great deal for our money. We have taken a bold leap, if you will—a bold experiment—to move out ahead and get where we need to be in theater ballistic missile defense. We have not solved all the problems yet. But I think, in summary, we think we are very close.

Tim, do you want to add to that?

Admiral HOOD. Yes. The second firing this morning that Admiral Lopez referred to was at 5:20 when the target was launched. About 5 minutes and 45 seconds later, the interceptor was launched from U.S.S. *R.K. Turner,* about 150 miles off the coast of North Carolina.

As Admiral Lopez indicated, the interceptor flew a nominal trajectory. It appeared to be right on the money. The kill vehicle did see the target, just before it was ejected from the third stage rocket motor. However, at ejection, the battery in the kill vehicle did not come up, and the kill vehicle was ejected unpowered and we did not achieve an intercept.

I cannot tell you exactly why. As we speak, the team is in place at Wallops Island right now going over a quick look of the data from the telemetry.

Senator LOTT. Do we have any more of these LEAP vehicles available? And when will we resume testing?

Admiral HOOD. No, sir. That was the last of this series of tests. We agreed with BMDO about 3 years ago to conduct these experiments with Terrier missiles off of our Terrier cruisers. The next step would be to put a kill vehicle on a Standard missile Block IV launched from a vertical launcher in an Aegis ship. That is what our program would be. We would proceed with that at a pace depending on the funding.

Senator LOTT. Just one other question, and then I will yield to our distinguished minority ranking member who just arrived.

General Garner, the fiscal year 1996 BMDO budget includes, as I understand it, $49 million for the boost phase intercept. My understanding is this program is really limited to the AIT kill vehicle, which may or may not be used for BPI.

What is the AIT being developed for? Is it primarily a BPI kill vehicle?

General GARNER. Well, when the Air Force first entertained the thoughts of a boost-phase intercept, they asked the organization in Huntsville, the technology organization in Huntsville, SSDC Huntsville, to help them on the kill vehicle. And we worked with the Air Force on that kill vehicle. But it is my understanding now that the Air Force has backed away from that and going toward more of a laser system rather than a kill vehicle.

[Additional information follows:]

The AIT is not primarily the BPI kill vehicle. The AIT was in development before its selection as the BPI kill vehicle. The AIT was chosen for BPI because it encompassed the requirements of the BPI mission and was a low risk solution with technological maturity. The AIT kill vehicle is the primary DOD hypersonic (i.e., speeds greater than five times the speed of sound) technology base, and has been developing hypersonic technologies since fiscal year 1990. The AIT technologies are being designed and tested for direct applications as upgrade, or technology insertion for TMD interceptors (e.g., THAAD, Corps SAM, PAC–3), and to provide an atmospheric intercept capability for future NMD interceptors (e.g., EKV). As a part of the program, the AIT has established the Aero-Optical Evaluation Center (a hypersonic shock tunnel) located in Buffalo, NY, which will be operational late in fiscal year 1995. This facility is world-renowned for its unique capability to duplicate conditions, on the ground, which were previously only possible through expensive flight testing.

Hit-to-kill intercept within the atmosphere is much more challenging than exo intercepts. To ensure an effective defense within the atmosphere against advanced theater and strategic threat requires a fast, agile and a very accurate kill vehicle. The purpose of AIT program is to address those challenges of intercepts within the atmosphere that are not being addressed by any other program within BMDO or DOD. The AIT kill vehicle is capable of operations at acquisition velocities up to 5 km/sec. The intercept environment at this velocity is considerably more challenging than at velocities being used by current TMD interceptors. The goal of AIT program is to use ground and flight tests to demonstrate the advanced technologies designed to resolve the issues associated with tactical and strategic hypersonic intercepts within the atmosphere.

To ensure a highly accurate, high performance, lightweight kill vehicle, we are developing and demonstrating hypersonic kill vehicle component technologies that address: Advanced cooled window technology and associated materials development for radio and infrared seekers, fast response control system, high data rate signal processing, high acceleration electronic systems, high temperature thermal protection materials, and high resolution infrared seeker for hit-to-kill accuracy.

Because the AIT is a broad-based program resolving the issues critical to both TMD and NMD, it should be continued to completion regardless of the status of BPI.

Senator LOTT. Senator Exon.

Senator EXON. Mr. Chairman, thank you very much.

I apologize to you, Mr. Chairman and our distinguished witnesses. We had a markup in the Commerce Committee this morning, and I could not get out of there. Because if I would have left, they would not have had a quorum, and we had to conduct some important business there.

This is a very important hearing, and I have a brief opening statement.

Could I read this for the record now, Mr. Chairman?

Senator LOTT. That would be fine; yes, sir.

Senator EXON. Thank you very much, Mr. Chairman.

I am delighted that the Subcommittee on Strategic Forces has planned to hold a number of hearings on the ballistic missile defense issues.

As I understand it, Mr. Chairman, the subcommittee will hold at least two other missile defense hearings in addition to today's—one to hear from General O'Neill, the BMDO director, about the 1996 budget request, and another on ABM Treaty issues, to which Secretary Christopher has been invited. I believe that these hearings, along with the full committee hearings on the BMD issues, will serve us well as we approach markup later this year.

Mr. Chairman, I join with you in welcoming the distinguished panel of witnesses today. As we are all aware, the Nation has already invested approximately $35 billion in the development of missile defenses with very little in the way of deployed hardware to show for that huge sum. Yet there are some Members of Congress—who shall remain nameless for now—who have argued for huge increases in the budget for ballistic missile defenses, apparently on the grounds that funding has been insufficient in the past.

I hope today's witnesses are prepared to make a strong case for the robust funding in their areas of responsibility that I think are very important.

I would simply say that—within the next few days, Mr. Chairman, we will be able to read this when I receive a final draft of a letter in response to a question that I had asked earlier from the Congressional Budget Office with regard to what the different billions of dollars in costs would be for aggressively deploying a national missile defense system as called for in the so-called "Contract With America." Because we do not have that blank check that we used to have during the Cold War when we would buy anything that popped or held some promise of popping to encourage our national defenses.

Those days are over and done with. Therefore, I think we have to do a much better job of refining what we think is in the best interest for the available funds that we have. And I have talked to many military leaders, including, to some extent, some of you here today with regard to the concerns that I have in this area.

Therefore, I will start in with a few questions, Mr. Chairman. And I would tell you, Mr. Chairman, that upon the final receipt of the CBO report that I just referenced, I would be glad to furnish you a copy of it. Because I know you and I have worked on this matter for a long time, and I think whatever the subcommittee eventually does on the issue of national defense funding is going to be a guidance for what the full Armed Services Committee and possibly the Senate will be doing.

Let me ask this question if I might. Admiral Hood, if the threat to the Hawaiian Islands or to the coastal areas of Alaska or the Aleutian Peninsula were to arise from North Korea's new missiles, would Aegis cruisers with the upper tier LEAP capability have any significant capability to defend those possible target areas?

Admiral Hood. A missile launched from North Korea into those areas would be an ICBM, and we do not anticipate having a strategic missile defense capability from Aegis cruisers in the near term.

Senator Exon. Well, would you amplify on that? Does anyone else have any statements in regard to that? Although I recognize it is in the Admiral's jurisdiction.

I guess what I am trying to get at, gentlemen, is for you to expand as best you can as to what the threat is. What is the possibility of the threat in the next 10-year period, for example, or 20-year period?

Could you be a little more forthcoming, Admiral?

Admiral Lopez. Let me try and help on that, Senator. Admiral Hood and I have talked about this repeatedly. The threat and our priorities, as we see the world evolving, is one where we believe that lower tier, first and foremost, is our highest priority. Because if we are going to do littoral warfare, which is the business of the Navy and the Marine Corps, and to support the Army and the Air Force as they arrive and, later, as they are resupplied, then we need to be able to knock out short-range ballistic missiles before they harm our troops or prevent us from resupplying or sustaining our forces.

The next most important area for us is—and we expect to leverage off of both of these—we simply think of upper tier and lower tier as one building on the other, but upper tier being a missile that would perhaps engage from 80 kilometers out to 400 kilometers, and would protect in the theater, as General Garner discussed, Korea to Japan or Libya to Southern Europe—that sort of thing—but not in the strategic sense, a theater sense.

So it is not a strategic system, but it is very important in the near term, because we have, as I recall, some 15 countries now that have the Scud-like missiles, and we are increasingly concerned with weapons of mass destruction and the biological and chemical-type warheads that would be fired against our troops. And we want to take those out as a first priority.

So that is why we put the Navy's priorities in lower tier and upper tier.

Senator EXON. Thank you very much. That is helpful to me.

Let me follow up on a question to each of you, a general question, if I might. Let me ask each of you to answer the following questions as best you can. It is reported that the administration's initial negotiating position going into the Geneva talks was that all theater missile defense systems would be exempted from the ABM Treaty so long as they were not tested against target vehicles travelling faster than 5 kilometers per second or on a flight path exceeding 3,500 kilometers.

Would each of you be prepared to support such a demarcation for theater missile defenses? Would you still support this if I told you that in 10 years Russia would once again be resurgent, both economically and militarily?

Now, I recognize that that is a dual question and there are some theory and supposition tied into it, but I think these are the types of things that you must be addressing. And as one member of this committee, I would like to delve into that for the record as best we could with the question that I have just asked.

General GARNER. Sir, we touched on that just before you came in. And I think the question was, were we consulted and did we agree with the reduction in the velocities of our interceptors as it pertained to that?

And from the Army standpoint, we were consulted and we did not agree. And we did not agree for the following reasons. Number one, when you slow down the velocities of our missiles, you limit the amount of battle space in which we have to address the problem. In other words, you shorten the time lines on it.

The second thing it does is it mitigates against us developing future systems for future threats. So we were not in favor of reducing the closing velocities of our interceptor.

I hope that answers your question.

[Additional information follows:]

ABM/TMD DEMARCATION

The Army would support the position that the only demarcation between theater and strategic ballistic missiles should be the maximum velocity and the range of the target ballistic missile. In this regard, the Army can support the proposal that incoming target ballistic missiles having a maximum velocity of no more than 5 kilometers per second and a maximum range of 3,500 kilometers constitute the upper limits of a theater ballistic missile (TBM). The Army would prefer not to limit the velocity of TMD interceptors. In fact the Army would prefer not to have any restrictions on TMD systems since they are not, as such, limited by the ABM Treaty. As long as we do not give such TMD systems significant capability to counter strategic ballistic missiles or conduct tests in conjunction with our NMD systems, there should be no limits on our TMD systems. Drawing the line between ABM and TMD capability in terms of the target velocity of 5 kilometers per second and the target booster's range of 3,500 kilometers is a useful and acceptable demarcation between TMD and ABM systems.

Senator EXON. General, I may have confused you with the question. I did not intend to. I am sure that you were sincere in your answer. I took it that your answer was something about a question with interceptors. Once again, I would repeat the question, and then try to explain my question further if that is necessary.

It is reported that the administration's initial negotiating position going into the Geneva talks was that all TMD systems would be exempted from the ABM Treaty so long as they were not tested against target vehicles—not interceptors—travelling faster than 5 kilometers per second or on a flight path exceeding 3,500 kilometers.

Is your answer the same, General?

General GARNER. I guess my answer is the same. We do not want to preclude the velocities of our missile system. Maybe we are talking at cross purposes here, Senator. On the surface, those limits seem to be a reasonable demarcation from TMD system, but I would want to do some analyses before I can agree with certainty.

Senator EXON. Well, maybe we are talking by each other. I guess, General, I did not ask about speed limits; I asked about limits on the target vehicles.

Admiral LOPEZ. I know what the Navy is trying to do. We certainly agree with General Garner's position on intercept velocities. We want all the intercept velocity we can get. But in responding to your question on target velocity, the Navy has been testing against systems that would be less than 5 kilometers a second target speed in basically those theater systems that are 3,500 kilometers or less.

So that is where we are in upper tier. That was what I was describing before, with an altitude of 80 to 400 kilometers, which is what you would expect a missile to fly at, at that velocity and range.

Senator EXON. Well, General Garner, let me follow up then on something else that I have in mind. The administration, in both its THAAD compliance report and its record on decisions of proceeding with the EMD flight test program, cited the use of cueing information, especially space-based cueing, as a compliance problem area.

General, you know the ABM Treaty relies solely on the National Technical Means for its verification. If the Russians were using space-based cueing information to improve the range of the TMD system, would not NTMs be adequate to detect what they were doing, or is it a case of us arbitrarily limiting our own capability?

General GARNER. Sir, I am not really able to answer what we can see the Russians do. But I can tell you that we have been limited on external cueing under Article 6–A of the ABM Treaty. There is an interagency decision that precludes us using external sensors, like the sensors we have in DSP, the Defense Support Program.

The reasoning for that is that we would be giving a non-ABM system an ABM capability. So what it has done is—the bottom line is that it does not have much impact on us in hardware development, but it has had impact on us in software development. And it has had some impact on us operationally, because it has shortened the time lines and shortened the battle space in which we can engage missiles.

[Additional information follows:]

EXTERNAL SENSOR

As you stated, the ABM Treaty does rely entirely on National Technical Means (NTM) as its only means of verifying compliance. In this regard, NTM has been adequate for assuring compliance with the ABM Treaty. However, the ABM Treaty does not directly address the use of external sensor data for cueing, and the use of space-based data has not been a compliance issue in the past. Nevertheless, some now believe the use of space-based cueing would give certain theater missile defense (TMD) systems the capability to counter some strategic ballistic missiles and, therefore, would be a violation of Article VIa of the ABM Treaty.

Senator EXON. General, thank you very much.

My first round time is up. I thank you, Mr. Chairman.

Senator LOTT. General, might I ask, where are you originally from?

General GARNER. Born and raised, sir?

Senator LOTT. Yes.

General GARNER. Born and raised on a ranch in Florida.

Senator LOTT. You talk good. I was just trying to figure that out. I appreciate it. [Laughter.]

General GARNER. Thank you. [Laughter.]

Senator LOTT. I do not have any trouble understanding you. Having said that, now let me give you sort of a lengthy question here—a series of questions—but I think they could be very important.

The proposed base closing list sent by the Secretary of Defense to the Base Closing Commission had some peculiar language regarding the missile wing and base at Grand Forks, North Dakota. It calls for closing the Grand Forks Missile Field unless, by December 1996, the Secretary finds that closing it would make difficult the initial deployment of the National Missile Defense System.

As I recall the ABM Treaty, if we build on the infrastructure of the old central system at Grand Forks, that site either has to be within 150 kilometers of the U.S. missile field, or it has to defend our Nation's Capital.

So here are the questions:

If the missile field at Grand Forks is closed, is the Grand Forks ABM site still within 150 kilometers of a missile field? If the Grand Forks site is not located close enough to either a missile field or the Capital, are we not obligated to dismantle most of the present site?

Under the ABM Treaty, would it be legal for us to dismantle the Grand Forks site and start over constructing a NMD site at a different missile field? How much is it likely to cost to dismantle Grand Forks and replicate the needed facilities elsewhere?

As you see, this recommendation has a lot of implications. How do you respond to those?

General GARNER. Well, first of all, sir, I do not know the answer to the cost, and I am not a treaty expert. But under the treaty, we are limited to one site. Grand Forks is a site best suited for us, because it is right in the middle of the heartland.

If you relocated to either coast, then it would be difficult to protect the opposite coast without breaking the treaty and having multiple radars or multiple sites. So anything that you do inside treaty compliance to mitigate against the deployment at Grand Forks would have impact on us.

Now, I can get you the rest of that detail later, but I am not prepared to answer that here.

[The information follows:]

GRAND FORKS ABM SITE

The Army is aware of the possibility that either one or both ICBM bases in North Dakota, i.e., Grand Forks and Minot Air Force Bases, may close. The Army is aware also that the ABM Treaty requires that an ABM deployment area contain ICBM silo launchers. As a consequence, closure of one or both ICBM complexes could require relocation of our ABM site at the Stanley R. Mickelsen Safeguard Complex. The Army is willing to work with the Air Force and other agencies to evaluate carefully the related issues that will mitigate the impact on our NMD. We are presently exploring various options to make NMD relocation unnecessary. We recognize that the final resolution of this issue may require discussions and agreement among the various agencies of the U.S. Government as well as formal notification to our ABM Treaty partners of the results.

Senator LOTT. Well, I guess part of the reason of my questions is to make sure you are considering all of these ramifications of that recommendation.

And with that, I want to thank you all for being here this morning.

Senator EXON. Can I have one more round?

Senator LOTT. Yes, go ahead.

Senator EXON. I have one more question, Mr. Chairman.

General Garner, I am going to read you the statement of the manager's language accompanying last year's conference report. And what that said—it is full of the discussion and talk about the Patriot PAC–3 risk reduction program, and I quote from that report:

The conferees recognize the advantage of investing in the backup for particularly critical or risky ERINT technologies and components. If such funds can be reallocated from the lower-priority programs, the conferees clearly agree as a general matter such risk reduction activity should be reviewed annually, and the funding level should be based on the successful candidate's rate of technical progress.

General, do you agree with the general philosophy contained therein from what I had just quoted from last year's conference report? And elaborate if you can as to what, if anything, has happened since a year ago that we should be alerted to that is either encouraging or discouraging to the different approaches that we have been working on.

General GARNER. Yes, sir. Let me cut to the chase on that one. The real issue is do we spend dollars to fly a Raytheon missile with multi-mode seekers?

In my former job as the force modernization person for the Army, I sent two letters to Congress last year—one to the House and one to the Senate. And I testified before the Senate last year, saying that I did not think that that was necessary. And my opinion has not changed from last year to this year.

Now, we spent thousands of manhours and thousands of hours in simulation down-selecting to the ERINT missile, the hit-to-kill missile. And I will tell you that, had the Raytheon multi-mode missile been the only missile available, I, in my previous job, would have gone to the leadership of the Army and said, let us start all over again with a blank sheet of paper, because this missile cannot give the requisite protection to our forces.

So what I think we need to do in terms of risk mitigation, is to spend dollars ensuring that we can integrate the ERINT missile, or the hit-to-kill missile, which I think is the technology of the future, into the current Patriot system. The bottom line is I do not think we need to spend any dollars flying the Raytheon missile.

Senator EXON. Gentlemen, thank you very much. And I again apologize for not being here earlier. I think this is a tremendously important meeting, and I am looking forward to the other hearings we are going to have on this subject.

Senator LOTT. I want to confirm, as you noted in your opening statement, we do intend to have a couple more hearings in this very important area. And we will leave the record open to allow members to submit questions.

Senator Smith of New Hampshire is very much interested in this area, and he had a death of a close friend and could not be here. He may have some questions he wants to submit to you for the record.

Senator EXON. We may have some additional questions for the record as well.

Senator LOTT. All right. Fine.

Thank you very much. The hearing is adjourned.

[Questions for the record with answers supplied follow:]

QUESTIONS SUBMITTED BY SENATOR TRENT LOTT

PAC–3 RISK REDUCTION

Senator LOTT. General Garner, the fiscal year 1996 budget includes $19.5 million for Patriot PAC–3 risk reduction to sustain work on the multi-mode missile. In your view, is such a risk reduction program necessary; if so, is the budget request for this effort set at the right level?

General GARNER. We are not putting this money into the multimode missile. The $19.5 million for fiscal year 1996 represents a continuation of the fiscal year 1995 efforts of hardware-in-the-loop and captive carry of the PAC–3 missile and the upgrade of the flight mission simulator located at Raytheon to make it compatible with the PAC–3 missile. We should pursue this hit-to-kill technology, and our dollars will be best spent in integrating the ERINT missile into the Patriot system.

CORPS SAM

Senator LOTT. General Garner, I have serious concerns about the Corps Sam program having to do with overall affordability and potential problems with the international teaming arrangement that is being discussed. Do you share these concerns?

General GARNER. In terms of affordability, I think what needs to be considered is that the Corps SAM system fills an important void in our Theater Missile Defense strategy by providing the lethality and the mobility to both focus on the short range missile threat as well as to provide protection for the forward maneuver force on the ground. And yes, I share the concerns of many lawmakers and service peers that the international teaming arrangement has inherent risk. As you are well aware, the Missile Defense Act of 1995 has just passed the Senate Armed Services Committee, and it terminated the Corps SAM program.

VIEWS ON NMD

Senator LOTT. General Garner, you were recently quoted in Defense News as saying that the threat does not warrant deployment of a national missile defense system in the near future. When would you recommend establishing an initial NMD capability?

General GARNER. Well, I am not sure that is exactly what I said. But if I did say that, that is not the way I meant to frame my remark. What I thought I said was that there are two scenarios that I think we have to consider. The first scenario is one of accidental launch. And we have always faced that threat. It has not happened yet. But because of the turbulence in the former Soviet Union, there may be some increased risk there now. I am not sure that there is, but that is one scenario.

The second one is a scenario of a rogue nation obtaining an ICBM capability. I think the intent is there. Saddam Hussein said if he had missiles that he could strike Washington, he would do so. Muammar Qaddafi said that given missiles of that capability, he would strike New York. And Abbas, the PFL leader, said if not my son, then the son of my son will have a missile that can strike New York. So certainly the intent to do that is there.

The question is, is the technology there?

There are a lot of ways you get the technology. If you can buy a system, then you can have instant capability. But if you cannot buy one, then the availability of both components and technology has dramatically shortened the time lines it would take to develop an ICBM.

Now, let me be clear about that. It is difficult for any country to develop an ICBM. But the technology is detailed in open literature. And you can read about it in open literature. Also, much of the hardware is available on the open market that you could go and buy.

So once you have TBM technology, then to take the next step to ICBM is much easier. For example, it took us 17 years in this country to build surface-to-surface missile systems that would range from 100 kilometers to 300 kilometers. But once we worked those problems out—and that was out in open literature—it took the North Koreans only 4 years to build a system to go from 300 kilometers to 1,000 kilometers. And today, we are projecting that they have a Taepodong that will go around 5,000 kilometers.

So the availability of component and knowledge has shortened the time line. The question is, how short is the time line, and would we as a Nation have adequate warning in such time that we could field an NMD system?

Certainly, if another country is developing or testing an ACBM system, that is observable to us. We will know that. The transfer of an entire weapon system is a little bit more difficult to detect. The transfer of components and technology is almost impossible to detect if you do not want us to detect it. And, again, advanced warning is going to vary to region and where it is occurring.

So there can be endless debate on whether or not there is a threat. I guess it comes down to the question, do you want to deploy an NMD system in this country as an insurance policy against the vagaries of our knowledge of the threat? And that is the question that has to be answered.

To the services, let me add, the question is, who is going to be the bill payer? Because all of us are in a time of resource constraints, and NMD is an expensive program.

So I cannot answer the question of whether or not the threat is there. It is in the mind of the beholder. I think it comes down to, is the amount of money it would take to field that system worth it as an insurance policy to our Nation?

NAVY LOWER TIER SCHEDULE

Senator LOTT. Admiral Lopez, the current Navy Lower Tier schedule is to produce a contingency capability (UOES) in fiscal year 1998 and a First Unit Equipped in fiscal year 2000. Is your fiscal year 1996 budget request of $237.5 million adequate to support this schedule? Could this schedule be accelerated at an acceptable level of risk and what would this cost?

Admiral LOPEZ. Yes, the fiscal year 1996 budget of $237.5 million will support the schedule as stated.

A $45 million fiscal year 1996 plus-up would permit recovery of a portion (up to 6 months) of schedule slip caused by the fiscal year 1995 reduction. It would also allow the Navy to conduct more intensive Lethality Testing sooner. BMDO will address fiscal year 1997–1999 increases in next year's budget submission.

Planned efforts for fiscal year 1996 include completion of the Infrared seeker risk reduction flight demonstrations, procurement of material for 35 UOES and 10 White

Sands Missile Range test missiles, and to continue Aegis Weapons System modification as well as STANDARD Missile Block IVA design and development.

UPPER TIER SPEED LIMIT

Senator LOTT. Admiral Lopez, what would be the impact of limiting the Navy Upper Tier program to an interceptor speed of 3 kilometers per second? Would you support such a limitation?

Admiral LOPEZ. For the Navy Theater Wide system we need the highest altitude capability and widest coverage possible. This allows us to take full advantage of available sea room to station our ships. Limiting interceptor velocity would limit our coverage.

The decision on limiting interceptor velocity is not mine to make.

The Navy Theater Wide system has recently been certified compliant with the ABM Treaty using a 4.5 km/sec interceptor.

NAVY TMD COEA

Senator LOTT. Admiral Lopez, the Navy TMD COEA is meant to identify, among other things, the best interceptor system for the Navy Upper Tier mission. What process will be used to ensure that all views and technical issues have been thoroughly and objectively studied in the COEA? Does the Navy plan to flight test more than one interceptor concept following the COEA? How and when does the Navy and MBDO plan to narrow the Upper Tier program to a single interceptor approach?

Admiral LOPEZ. Scenarios have been designed to simulate various overseas crisis situations where theater ballistic missile defense would be required. The scenarios will be run using each interceptor alternative for two timeframes, 2002 and 2010. The results of these simulations will be analyzed against pre-determined measures of effectiveness and performance. The cost of each interceptor alternative will be estimated and reviewed.

An oversight board, comprised of senior military officers and civilians, has been established and meets on a regular basis to ensure the COEA process is accurate and fair.

The results of the Navy COEA will have a significant impact on the Theater Wide interceptor concept that the Navy chooses. I believe that we must wait for these results prior to speculating on programmatic decisions regarding a flight test program or the method for selecting the interceptor.

QUESTIONS SUBMITTED BY SENATOR J. JAMES EXON

NATIONAL MISSILE DEFENSE FROM AEGIS SHIPS

Senator EXON. Admiral Lopez, I am sure you have seen various contractor viewgraphs that purport to show that the Navy's Upper Tier TMD system with the LEAP kill-vehicle and a good kick motor could provide a thin area defense of the CONUS against some Russian strategic missiles with just two Aegis cruisers—one in Boston Harbor and one in Puget Sound. I know the Russians have not only seen those viewgraphs, they wave them at our negotiators in Geneva. Admiral Lopez, do these viewgraphs depict a real capability to defend CONUS, or is this contractor puffery? If they do not, would you provide the committee with the Navy's assessment of the capability and coverage against the least-capable Russian strategic missile to be retained under the START II Treaty?

Admiral LOPEZ. We believe the Theater Wide system with a Standard Missile and LEAP kill vehicle has no capability to counter any strategic missiles.

The Navy Theater Wide system has recently been certified compliant with the ABM Treaty using a 4.5 km/sec interceptor.

THAAD AS AN ABM CAPABILITY

Senator EXON. General Garner, the administration has told us that the fully-developed version of the THAAD system would have a significant intercept capability against some Russian strategic missiles that they will retain even under START II (if ratified). If we were to take the defended area footprint for the THAAD against just that part of the Russian inventory it can engage, can you tell us how many THAAD batteries we would have to acquire in order to defend, say, the top 50, or top 100, populated areas in the United States? How does this figure compare to the number of THAAD batteries that the Army currently plans to acquire?

General GARNER. The administration's assessments of THAAD capability to engage the former Soviet Union Strategic Ballistic Missile (SBM) threat have been based on a very strict interpretation of the ABM Treaty. Under this interpretation, [deleted]. The Army currently plans to procure eight THAAD batteries.

ACCEPTABILITY OF THE ADMINISTRATION'S POSITION

Senator EXON. General Garner and Admiral Lopez, let me ask each of you to answer the following question: It is reported that the administration's initial negotiating position going into the Geneva talks was that all TMD systems would be exempted from the ABM Treaty so long as they were not tested against target vehicles travelling faster than 5 kilometers. Would each of you be prepared to support such a demarcation for TMD systems? Would you still support this if I told you that in 10 years Russia would once again be resurgent both economically and militarily?

General GARNER. Yes, I would still support the 5 kilometer per second (kps) demarcation. An acceptance of the target velocity limit of Defense (TMD) systems that are not restricted by the Anti-Ballistic Missile (ABM) Treaty and ABM systems that are restricted. In addition, the 5 kps target velocity demarcation would still give the United States a viable TMD capability against the full range of TMD threats today and 10 years into the future. TMD capability against targets with velocities up to 5 kps should capture all the TMD threats the U.S. theater forces would encounter in the foreseeable future.

Admiral LOPEZ. We support 5 km/sec and 3,500 km range as the demarcation point between strategic and tactical targets.

Capability against strategic targets is limited under the terms of the ABM Treaty. The Navy Theater Wide system has recently been certified compliant with the ABM Treaty using a 4.5 km/sec interceptor.

[Whereupon, at 10:46 a.m., the hearing was adjourned.]

DEPARTMENT OF DEFENSE AUTHORIZATION FOR APPROPRIATIONS FOR FISCAL YEAR 1996 AND THE FUTURE YEARS DEFENSE PROGRAM

TUESDAY, APRIL 25, 1995

U.S. SENATE,
SUBCOMMITTEE ON STRATEGIC FORCES,
COMMITTEE ON ARMED SERVICES,
Washington, DC.

DEPARTMENT OF ENERGY'S ENVIRONMENTAL MANAGEMENT PROGRAM AND DEFENSE NUCLEAR FACILITIES SAFETY BOARD REAUTHORIZATION

The committee met, pursuant to notice, at 2 p.m. in room SR–232A, Russell Senate Office Building, Senator Dirk Kempthorne presiding.

Committee members present: Senators Kempthorne, Thurmond, Warner, Exon, Levin, Bingaman, and Glenn.

Committee staff members present: Richard L. Reynard, staff director; George W. Lauffer, deputy staff director; and Ann M. Mittermeyer, assistant counsel.

Professional staff member present: Gregory J. D'Alessio.

Minority staff member present: William E. Hoehn, Jr., professional staff member.

Staff assistants present: Kathleen M. Paralusz and Jason Rossbach.

Committee members' assistants present: Glen E. Tait, assistant to Senator Kempthorne; Andrew W. Johnson, assistant to Senator Exon; David A. Lewis, assistant to Senator Levin; Edward McGaffigan, Jr., assistant to Senator Bingaman; Christopher R. Kline, assistant to Senator Glenn; Suzanne Dabkowski, assistant to Senator Robb; and Randall A. Schieber, assistant to Senator Bryan.

OPENING STATEMENT OF SENATOR DIRK KEMPTHORNE, PRESIDING

Senator KEMPTHORNE. Ladies and gentlemen, the hour of 2 p.m. has arrived. I would like to call this meeting to order. The Strategic Forces Subcommittee meets today to hear testimony on the Department of Energy's Environmental Management Program.

Our witnesses today include: the Assistant Secretary, Tom Grumbly; Robert Galvin, Chairman of the Secretary of Energy's Task Force on Alternative Futures for the Department of Energy National Laboratories, known as the Galvin Committee; and Dr.

Henry Kendall, Chairman of the Galvin Committee's Subcommittee on Environmental Management Programs. The subcommittee will also hear from Mr. John Conway, Chairman of the Defense Nuclear Facilities Safety Board, on the second panel.

Mr. Grumbly, Tom, I have enjoyed working with you over the last few years, and I say that with all sincerity. During that time, you and I have dealt with a number of complex and challenging issues, and I have always respected your commitment and your professionalism. We have a number of difficult issues facing us today, and I very much look forward to our discussion of these issues.

The Department of Energy's Environmental Management Program, known as the EM Program, seeks $6.59 billion for fiscal year 1996. While this request appears to represent an increase from the fiscal year 1995 funding level, it is in fact a decrease because large additional responsibilities such as the management of the Savannah River Site have been added to the program. In addition to the administration's proposal to reduce funding for the Department of Energy's EM Program, Congress recently enacted a $200 million recision of EM funds.

The subcommittee wants to hear about the impact of these cuts. Over the long-term, however, Secretary Grumbly, you have outlined a gloomy $17 billion "train wreck" between projected Department of Energy cleanup funding and Department of Energy cleanup requirements over the next 5 years. This funding "train wreck" has increased doubts about the Department of Energy's ability to meet the binding cleanup commitments it has made to various states around the Department of Energy complex.

Recently, the Department of Energy has published a baseline report which estimates that the total cost of the EM Program will be $120 billion to $350 billion over 75 years. The committee will want to look at the assumptions behind this estimate and assess the influence of the "risk aversion factor" warned of in the Galvin Report.

The 75-year baseline report also assumes no significant use of advance technology. It seems to me that this factor partially explains the huge cost estimate. This assumption is comparable to someone in the year 1920 looking at a project which would be completed in 1995 and assuming that there would be little or no technology advancement.

Over the last few weeks, the EM Program has been criticized by experts both inside and outside of the Department of Energy. These experts have questioned the fundamental strategy, direction, management, and leadership of the EM Program. For example, a report evaluating the Hanford cleanup, prepared by Steven Blush and Thomas Heightman for the Senate Energy and Natural Resources Committee, concludes: "The mission of cleaning up the site has gotten lost in the legal and regulatory framework that governs it."

It further states, "In sum, DOE, EPA, and the State of Washington are asking the American people to pay for a program to deal with Hanford's large volume of high-level waste that, in certain fundamental respects, makes no technical, political, or financial sense."

The report suggests, "Few agencies, contractors, or individuals appear willing to raise basic questions about the current philosophy of this program, because it has been endorsed by the 1989 Tri-Party Agreement."

Likewise, the Secretary's own Science Advisory Board within the so-called Galvin Committee Report has identified numerous problems and shortcomings with the Department of Energy cleanup program. It is my hope that today the hearing will give us an opportunity to see how the Department of Energy has responded to each of the major criticisms and recommendations of Mr. Galvin and Dr. Kendall.

In short, today we have questions not only about funding, not only about performance, not only about commitments, but questions about whether the entire philosophical and regulatory basis must be altered. In light of these questions, the committee must determine whether a wholly new approach is required in order to provide real environmental and health protection to the people living near these sites without bankrupting the U.S. Treasury. Instead of an approach that at times is wasteful, overly legalistic, inflexible, and geared toward fear and punishment, we need to stress American cooperation, creativity and efficiency to get the job done. I know Secretary Grumbly will want to work with this committee to achieve just such a system.

Secretary Grumbly, in addition to these very important questions and challenges, you know I want to discuss the Department's recently released final EIS on the storage and management of spent nuclear fuel. As you know, last week the Department of Energy released its final EIS with a preferred alternative that recommends sending 1,950 shipments of spent nuclear fuel to the Idaho National Engineering Laboratory and 1,710 shipments to the Savannah River Site for the next 4 years.

I want to encourage you and Secretary O'Leary to modify this preferred alternative before the record of decision is signed, because as the Governor of Idaho, Governor Bass, has made perfectly clear, "The people of Idaho will resist any effort to turn our State into a defacto nuclear dump." I believe that the Chairman of the full committee, Senator Thurmond, has grave doubts about the equity of having the people of South Carolina accept 840 shipments of spent fuel from foreign research reactors, essentially half of the shipments which the Department of Energy proposes for that State.

Mr. Secretary, the Department of Energy is asking Idaho and South Carolina to accept hundreds of shipments of spent nuclear fuel over the next 40 years, based upon a promise that sometime in the undefined future this material will be sent to a final repository. Idahoans are already familiar with the Department of Energy's definition of "interim storage," and we will not be fooled by those words again.

Instead, Governor Bass put forward a fair compromise out of this situation. Under the Governor's proposal, the State of Idaho will not accept any more shipments of spent nuclear fuel until we receive an absolute assurance that the materials will be sent out of the State.

In my mind, that means the administration must support the establishment of an interim storage facility at Yucca Mountain. Without an absolute commitment to a path forward for spent nuclear fuel, I predict that the State of Idaho will go to court to block additional shipments.

Mr. Secretary, as I see it, we find ourselves in this situation because we have thrown away every major scientific and technological tool at our disposal. Let us review the record. The United States no longer reprocesses spent nuclear fuel. The administration killed the Integral Fast Reactor Program last year. Yucca Mountain is a billion dollar paper exercise. The opening of WIPP has been delayed. Public utilities are running out of space to store their spent nuclear fuel, and the administration refuses to support pending legislation to open an interim storage facility. Instead of answers to a growing national problem, we get proposals to ship more spent nuclear fuel to Idaho and Savannah River. Instead of leadership, we get a policy of muddling through. Something must change. Mr. Secretary, we do not simply have a technical problem, we have a lack of political will. Instead of addressing a growing, seemingly intractable national problem, this administration, like administrations before it, is content to kick the problem down the road.

Secretary Grumbly, I am here to tell you that Idaho is down at the end of that road, and a policy of interim answers and interim solutions will no longer suffice. I have no doubt the great minds in Los Alamos, Lawrence-Livermore, Sandia, Oak Ridge, Argonne, and INEL can solve the problems we face today, but they need leadership and they need inspiration and they need direction to tackle these tough issues. We must work together to do this before your program finds itself in a quagmire of litigation.

Mr. Galvin and Dr. Kendall, I also wish to say to you that I appreciate the opportunity to have your insights into potential solutions for this critical national problem. Mr. John Conway, of the Defense Nuclear Facilities Safety Board, will speak on the subject of his Board's proposed activities for fiscal year 1996 during a second panel later this afternoon. However, let me take this opportunity to invite his advice on the Department of Energy EM Program at that time.

Before I turn to Secretary Grumbly and to our distinguished panel, let me ask Senator Bingaman if he would like to make any comments.

Senator BINGAMAN. Mr. Chairman, I do not have a prepared statement. I welcome the witnesses. We have a lot of interesting issues before the subcommittee today.

Senator KEMPTHORNE. Thank you, Senator Bingaman. I welcome your involvement with this. Mr. Secretary, would you like to provide us with your thoughts?

STATEMENT OF THOMAS P. GRUMBLY, ASSISTANT SECRETARY OF ENERGY FOR ENVIRONMENTAL MANAGEMENT

Mr. GRUMBLY. Mr. Chairman, thank you for the opportunity to testify today. I am struck by the challenges in your opening statement, and I hope that during the next couple of hours we will have the opportunity to really get into it in some depth. I have a full statement for the record, and I would like to enter it at this time. As I do, I would like to apologize to the committee for the lateness with which the statement was provided. We are obviously not as reinvented as we need to be down at the Department of Energy, but I hope you and your staff will accept our apologies. I do have a brief written statement and an oral statement that I would like to present.

I think in contrast to some of what I heard in your opening statement, Senator, that this year the Department of Energy's Environmental Management Program has really turned some corners in a positive direction. We have turned the corner on the budget. For the first time in the program's history, which stretches back into the Bush administration, our request is a reduction in budget, given the same scope of work.

Though our total program budget request appears greater than last year, as you indicated, it is actually a 4 percent reduction, and this is because the Environmental Management Program took over about $840 million worth of responsibilities from the Department's Office of Defense Programs. Absent these new tasks, our 1996 request is a reduction of about $235 million from last year's appropriation.

I think we have also turned the corner on results. For the first time in the program's history, we are devoting more resources to actual cleanups than to paper studies. I think we are turning the corner on efficiency. We are proposing massive reductions in our budget requests and have implemented ambitious management changes to improve productivity in this program, accounting for a leaner program and more than $2 billion worth of savings between fiscal years 1994 and 1996 already.

I think we have turned the corner on setting priorities. This year's request reflects our continued efforts to address the most urgent risks first and to focus our limited resources on getting results, rather than trying to be all things to all people. Today, I would like to briefly outline the program and our accomplishments, the challenges we face, and our plans for the future.

First, let me point out the Environmental Management Program's significant contribution already to a leaner Federal Government and deficit reduction in line with the President's proposed budget. As I am sure all of you know, the Department of Energy's budget is being reduced by at least $10.6 billion over the next 5 years. The EM Program's budget reductions will account for the largest proportion of this cut. For fiscal years 1997 through 2000, our request will be reduced by at least $4.4 billion in outlays, or approximately $5.5 billion less in budget authority.

These reductions are significant, but I think they are achievable with the kinds of productivity savings and the kinds of changes in regulatory reform that we propose to achieve over the next year. But I think we should not make any mistake about it. There are limits to how large and how fast budget reductions can happen without jeopardizing our fundamental ability to meet our legal and moral obligations to protect human health and safety.

We have carefully planned substantial reductions over the next 5 years along a manageable course of decline. A precipitous cut in fiscal year 1996 will present serious problems to our program and "could"—and I underline the word "could"—significantly increase the likelihood of a serious accident at one of our sites. Let me explain why.

Many people believe that this program is simply a cleanup program. This, I think, is an unfortunate misunderstanding. Although environmental restoration is an integral part of our mission, it is only one component. Our job also includes the safe operation of vast installations in this country and managing extraordinarily dangerous nuclear materials.

Our responsibilities include some of the Nation's most urgent environmental risks, such as hundreds of underground tanks of high-level radioactive waste in Idaho, South Carolina, Washington, and Upstate New York. Most are the size of the Capital Dome with capacities of, roughly, a million gallons each. We also manage many hundreds of tons of intensely radioactive spent nuclear fuel and over 27 metric tons of weapons' usable plutonium, the stuff of nuclear warheads. Given the seriousness of these tasks, there really is no margin for budget error.

Currently, about 65 percent of our program budget is driven by compliance with legal obligations, and that is obviously something I think we want to explore during the rest of this hearing. An additional 25 to 30 percent of the budget is governed by vital nuclear material safety responsibilities that are not part of the current compliance agreement regime. This leaves little room for further efficiency gains and establishes a point beyond which further budget cuts will go directly to the essence of our vital missions and undermine our efforts.

The Department's Office of Environmental Management, established in 1989, manages the largest environmental stewardship program in the world, estimated, as you indicated, to cost several hundred billion dollars over the next several decades. In fact, our recently released baseline environmental management report which attempts the very difficult job of analyzing lifecycle costs based on several different sets of assumptions, estimates a range from approximately $175 billion in 1995 constant dollars, if we do nothing more than merely contain our mess within iron fences, to as high as $500 billion for returning our sites to the so-called "Greenfield" conditions over the next 70 years, depending upon the level of cleanup assumed.

I want to indicate at this point that the assumption about technology that is in the Baseline Environmental Management Report is not our prediction about the absence or progress in technology development, it is merely a baseline to give us a place to assume where we go from here.

You have given us the requirement, this committee in the past, and I assume will so in the future, to update this baseline over time, and we will be able to begin to factor in real changes that technology development will make for us.

I do not expect that we are going to spend $230 or $250 billion without significant changes in technology over some period of time, but you cannot know how well you are doing unless you know where you are coming from. Our job is not to fool this committee or to fool Congress into assuming that we are going to be able to make vast changes. We need to be able to measure it as we go along.

Some people have said that we have not gotten anything yet for our money. I think this is misinformation. I do not think people who think this have really done their homework. We have done a lot already. Since the establishment of this program, we have treated a total of 4.2 billion gallons of ground and surface water, enough to fill the Reflecting Pool between the Lincoln Memorial and the Washington Monument 624 times.

We have also removed more than 30 million cubic meters of contaminated soils and uranium tailings, enough to fill the Kibbee Dome, where the University of Idaho Vandals play, almost 78 times—although, this is not where we intend to put it. [Laughter.]

In just the last year, we have transferred 199 spent fuel elements at the Idaho National Engineering Laboratory in the safer storage facilities at that site in line with the agreement that we made with Governor Andrus in the middle of 1993. We have begun to stabilize inventories of pyrophoric plutonium that can be extremely unstable, that can explode and burn spontaneously under certain conditions, and we have converted 700,000 gallons of high-level radioactive waste into a safer, more stable, dry calcine form at our site in Idaho, again in line with the agreement that we made with the previous Governor.

We cannot stop here. A whole lot remains to be done. We are committed to getting a lot more results in fiscal year 1996. Some of the things we plan to do are, one, continue to upgrade the storage of spent nuclear fuel to prevent worker and environmental exposure, as well as provide security in support of the Nation's nonproliferation goals.

Second, finally, and I underline "finally," begin to operate the Defense Waste Processing Facility at the Savannah River Site, which will transform highly toxic radioactive waste into stable glass logs. Finally, complete the stabilization of the inventories of plutonium at the Rocky Flats site that present fire hazard. This program is also a prominent part of the Nation's science and technology development effort. One of the challenges we face is the lack of affordable and/or effective technologies for many of our contamination and waste management problems, the technology application gap, if you will.

The Department's national laboratory system is a critical tool in developing newer, more effective, and cheaper environmental technologies to allow us to effectively carry out our environmental projects. We currently spend about 45 percent of our Department's technology application budget at the national laboratories. The Galvin Task Force released its report earlier this year, and I am very happy that Bob Galvin and Henry Kendall are joining us today to discuss the Task Force's work. We agree with many of the findings and recommendations and have already begun to implement some of them.

For example, we would like to see more lab involvement in environmental technology work. One way we are fostering this involvement is through our Office of Technology Development's lead lab concept in each of five major environmental focus areas. These focus areas direct applied research efforts and the challenges faced by each of our program offices.

We also support more basic science work. I would like to see more funding of this type of work in the fiscal year 1997 request, now that we know that this is a three-generation problem at least in terms of dealing with this, and you can expect to see a better fundamental research budget from us in the future than you have had in the past.

The report also mentioned establishing an Environmental Advisory Board of high-calibre, technical, and scientific advice. Our Environmental Management Advisory Board has existed since 1990, and we have recently restructured it to include at least four eminent scientists, including Dr. Bernard Goldstein, who served in the Reagan administration as assistant administrator in charge of the Environmental Protection Agency's Office of Research and Development, and Dr. Lyn Ansbaugh from Lawrence Livermore National Laboratory.

Indeed, we have one of the two chartered advisory committees in the Department of Energy at the moment. While I am sure we can do better, I think we have made a major effort in this direction. In general, we believe that there is much more common ground than disagreement with the Task Force's report. We have and we will continue to use the laboratory system, to the extent that it can compete in producing useful results in a cost-effective manner compared to other sources of research and technology.

I am sure that after we have lifted the heavy yoke of internal regulation from the laboratories that they will almost, by definition, become more cost-effective, and then we will actually have a true competition among the labs to see where we can get the best for the taxpayers' dollar.

Let me turn specifically to our budget request. Our 1996 budget request is approximately $6.6 billion. As I said, it includes $843 million in funding for significant new responsibilities at three sites, transferred from the Defense Programs Office. The Savannah River Site, in South Carolina; the Mound Plant, near Dayton, Ohio; and the Pinellas site, near Clearwater, Florida; as well as some other high-risk facilities.

The requested amount will allow us to carry out our legal obligations during fiscal year 1996 with a very few exceptions that we have already begun working with State regulators to resolve. However, after 1996, even with the continued productivity savings that we need to get, there will be a gap between available resources and our current legal requirements. I would like to explain just for a moment how we plan to meet our legal and moral obligations given our declining resources in this area.

First, we need to change the way we do business. In the previous administrations, indeed in all previous administrations where the Department of Energy was concerned, when our program was created, the necessary ramping up of budgets was carried out in an atmosphere which created an organizational atmosphere that cost was no object. This is no longer the case. It was not the case when we first came in.

We leveled the budget in the first year we were here, but now we are on the road to downsizing this, and downsizing it in a rational way. The President's 1996 budget carefully constructs a downramp for our outyear budgets. We are making substantial changes in our management practices in order to increase efficiency and reduce costs. For example, we are recompeting and renegotiating over $30 billion worth of contracts to include greater incentives for outstanding performance and to ensure that the contractors and not just the taxpayers take on a larger share of the risks associated with doing business.

We want to reward excellence, not mediocrity. We are reducing the number of contractor employees around the system by nearly 18,000. This is a painful process, but it will eliminate unnecessary layers of contractor employees, and leave us with those workers with the right skills and experience in our environmental mission. I think we are finally stepping up to the plate and doing what should have been done over the last 5 years; and that is, rightsizing this complex for the amount of environmental work that really needs to be done.

We continue to utilize risk-based assessments in determining where to allocate resources to address truly urgent risks first, and we are on schedule to deliver a required report to Congress this June in which we will let everybody know where we think our resources are allocated against the risks that are out there.

These initiatives are ambitious. In fact, I think if you compare our management goals of, roughly, a 30 percent productivity improvement between 1994 and the year 2000 to those of Fortune 500 companies, we are pushing the limit of what an organization can achieve in efficiency gains. Indeed, former Secretary of Defense and Secretary of Energy, Mr. Schlesinger, has told me that he thinks we are already outside the bounds of what can really be achieved in the Federal environment. I disagree, but I think we are at the edge of what we can do.

To ensure that we continue to meet our legal obligations, we are working with the regulators to change compliance agreements that apply to the Department. Let me take a moment to emphasize this point. There is a lot of talk about changing our budget and changing the laws, and we are very interested in working with Congress on these changes.

We have, I think, to be clear about one thing. Unless and until the environmental laws are changed, we are duty bound by you to honor these laws. We cannot pick and choose the laws we obey, and the Department is committed to complying with the laws that apply to its sites and operations.

When Secretary O'Leary and myself took these jobs, we took an oath of office to uphold the Constitution and the laws of the land, and we take those oaths very seriously. We urge Congress not to reduce this budget unless it is willing to deal with the underlying statutes that drive them. Again, we can and should have debates about the laws and regulations. I testified this year about contemplated changes to increase the consideration of risk and environmental loss.

We have also long supported changes to Superfund, such as taking into account future land uses and worker risks that would make this law which drives approximately $2 billion of our costs, and make it work better and cost less. Unfortunately, these changes were not enacted last year. I hope they will be enacted this year. For now, we are able to meet our responsibilities and improve upon our performance.

I am happy to report that we have substantially increased our compliance over the last 3 years from 75 percent to greater than

90 percent, and I think this is a performance that is better than most private corporations in the whole environmental compliance area. But the outyears are a problem. We are working vigorously with States right now to fix that.

Many of our compliance agreements were signed during a climate that is much different from the one that we have today. Some of the milestones and schedules for completion are technically unworkable. Indeed, I would estimate, the good news is, that somewhere between 80 to 85 percent of what we do makes a lot of sense, but there is 15 to 20 percent that does not. When you are talking about a budget of this size, you are talking about nearly a billion dollars. That is a billion dollars we think we have to make up per year over the next few years.

Recognizing this, it is a reasonable and, indeed, sensible thing to work as cooperatively with the States, citizens, and the Federal Environmental Protection Agency to renegotiate our agreements as appropriate to align them more with current fiscal reality. Another goal of renegotiating these agreements is to ensure that they will achieve the greatest risk reduction and risk prevention per dollar spent.

To conclude, through ambitious changes in managing this program, significant cost savings have already been realized without any negative impact on the amount of work that we are accomplishing. Indeed, this budget that we have proposed jams about $8 billion worth of work into about $6.5 billion worth of funding because of the major productivity increases that we have proposed. They are not just sort of generalized terminology.

I mean, 18,000 people, which is a tough guess, are going off the rolls in order to help us meet this kind of situation and to drive down the indirect costs and overheads that we have. The story is only beginning, however. The task before us, as you have laid out, Senator, in dealing with the environmental mortgage of the Cold War will not simply go away, and many of the risks that we face cannot be put off until tomorrow.

We must continue to address the urgent risks that require immediate attention, as well as the long-term persistent threats that will pose hazards and cost money far into the future. Though there is a distinction between immediate risks and long-term threats, we must not think that the latter can be simply ignored until tomorrow. We do not put out a fire only to return home with a gas leak. Both of the situations require attention immediately.

Our fiscal year 1996 request represents an absolute reduction relative to work scope and reflects our commitment to meet our responsibilities as affordably as possible. We will continue to seek and capitalize on opportunities to increase both efficiency and productivity, but I think there is a line beyond which savings may come at the price of safety.

Thank you for your time, and I am happy to answer your questions.

[The prepared statement of Mr. Grumbly follows:]

PREPARED STATEMENT BY THOMAS P. GRUMBLY, ASSISTANT SECRETARY FOR ENVIRONMENTAL MANAGEMENT

Mr. Chairman, and members of the committee, I appreciate this opportunity to appear before you to discuss the Department of Energy's fiscal year 1996 budget request for the Department of Energy's Environmental Management (EM) program. This program manages the human health and safety and environmental contamination consequences of the Nation's 50 year nuclear weapons research, production, and testing program.

In my testimony, I will:

- Begin with some background of the Environmental Management program and describe the progress we have made, the challenges we face, and what we are doing and propose to do about them;
- Present an analysis of the budget requests for each program area, explaining the major activities, accomplishments, and commitments for each program; and
- Discuss some of the new program initiatives and progress being made toward achieving our strategic goals.

INTRODUCTION

Last year the Department submitted a budget request for the Environmental Management program that was essentially flat, halting the trend of increasing budget requests that had occurred since the program was established in 1989. This year, I can report that this trend is being reversed with our fiscal year 1996 budget request, which represents a *reduction* from last year given a comparable work scope. We have made substantial progress in changing the way we do business and have achieved increased cost savings through efficiency gains and productivity improvements. This effort translates into safer working conditions, better protection of public health and safety, and a cleaner environment. All at less cost to the taxpayer.

The Environmental Management program, is playing a significant role in contributing to a leaner Federal Government and deficit reduction as part of the President's proposed fiscal year 1996 budget. The entire Departmental budget is being reduced by $10.4 billion over the next 5 years. The Environmental Management program budget request will account for a large portion of this reduction. For fiscal years 1997 through 2000 our request is being reduced by $4.4 billion in outlays, which translates into a $5.5 billion reduction in requested budget authority over the same period, from the previous budget targets established by the administration. I believe these are very aggressive, but, ultimately achievable reductions.

Our fiscal year 1996 request reflects a continued commitment to solving environmental and safety problems as well as a continued commitment to improve the way the Department does business. Our request includes funding for major added responsibilities previously in the Defense Programs budget. The new scope includes management of the Savannah River site in South Carolina, the Mound site in Ohio, and the Pinellas Plant in Florida and 18 high risk facilities and 16 supporting facilities. Without the additional transferred scope of work, the Environmental Management base budget request for activities in waste management; environmental restoration, nuclear materials and facilities stabilization, and technology development is actually 4 percent less than the amount appropriated in fiscal year 1995.

The Environmental Management program is committed to doing more with less now and into the foreseeable future. The aforementioned reductions in outyear budgets will take place over a 5-year period to allow us to ramp down in a controlled fashion. More extreme budget cuts beginning in fiscal year 1996 would likely have negative consequences.

First, a drastic drop in our resources could diminish our ability to protect human health and safety at our sites. We have focussed significant attention on the most urgent risks at our sites. But, we cannot afford to defer indefinitely the lower priority efforts. Deferring problems only increases costs later and saddles future generations with the problems, and may, in some cases, cause the cleanup to be more expensive and more dangerous as conditions deteriorate.

Second, extreme budget cuts could also cause the Department to be out of compliance with its environmental requirements. Roughly 65 percent of our budget is driven by enforceable agreements. Without the needed time to renegotiate and reconfigure these agreements, where appropriate, to account for funding constraints and other factors, we may be unable to comply with them. This could result in the Department being subject to administrative or judicial enforcement orders and fines and penalties.

The Environmental Management program has many responsibilities, one of which is storing securely more than 25 metric tons of plutonium to prevent theft, sabotage, or diversion. We take our traditional environmental and waste management responsibilities very seriously. But, certain nuclear materials we handle have the potential for much greater harm. A mistake in safeguarding this nuclear material could result in incalculable calamity on a global scale. Nonetheless, nearly 50 years of nuclear weapons production have left us with a massive environmental legacy which we have a moral and legal obligation to address.

BACKGROUND ON THE ENVIRONMENTAL MANAGEMENT

The Department's Office of Environmental Management manages the largest environmental stewardship program in the world with over 130 sites and facilities in over 30 States and one territory. When it was established in 1989, the program was called environmental restoration and waste management. Since then, however, the importance of other missions, such as nuclear materials and facilities stabilization and technology development have grown significantly. The number of sites and facilities under our management has also grown as more buildings are determined to be surplus. The nuclear weapons production complex alone is spread over thousands of square miles in 13 States. Nuclear weapons production operations were shut down in the late 1980s, leaving a legacy of thousands of contaminated areas and buildings, huge waste volumes, and a large amount of hazardous nuclear materials still in the pipeline of their production processes. The Environmental Management program's responsibility is to address the most immediate, urgent risks to human health and the environment as well as manage the long-term contamination and safety threats.

The task of Environmental Management is a significant one. To illustrate the extent of this task here is a short list of the wide variety of threats and risks facing the Department:

- hundreds of large, underground high-level radioactive waste tanks, many of which have leaked, and some of which may pose danger of an explosion;
- thousands of metric tons of highly radioactive spent nuclear fuel in various types of storage, some corroding; and
- thousands of radioactively contaminated buildings that must be stabilized and eventually decontaminated;
- contaminated drinking water, soils, and surface water;
- worker exposure to radiation and chemicals;
- theft or diversion of nuclear weapons material (e.g., plutonium and highly enriched uranium);
- industrial and transportation accidents.

We simultaneously satisfy a wide variety of demands:

- compliance with State and Federal laws and regulations;
- compliance with negotiated agreements stemming from those regulations or court orders;
- International Atomic Energy Agency nuclear nonproliferation safeguards requirements;
- Defense Nuclear Facilities Safety Board "Recommendations";
- Worker safety and health protection expectations derived from OSHA, nuclear industry, and Departmental practices;
- Short- and long-term technology development needs; and
- Worker and community development needs (e.g., training and land reuse).

The task ahead remains formidable. Yet, we are taking some tangible steps now to identify and mitigate the environmental and health risks at our sites.

In March the Department completed the 1995 Baseline Environmental Management Report which provides life-cycle cost estimates for completing the DOE environmental management mission. The Baseline Report, which was required by the Fiscal Year 1994 National Defense Authorization Act, includes descriptions of projects, activities, remedies, schedules, and estimated costs for addressing the environmental problems at DOE sites. In addition to a "Base Case" program estimate, alternative scenarios were developed by modifying the following variables: future land use, funding, technology development, and waste management complex configuration.

The "Base Case" total program cost ranges from $200 billion to $350 billion (constant 1995 dollars) depending on productivity assumptions. The Baseline Report analysis assumes program activities through the year 2070; however, 90 percent of estimated costs would be incurred during the first 40 years. The Mid-Range Base Case estimate is $230 billion, assuming 20 percent productivity improvement through 2000 and 1 percent annual improvement thereafter. This is the productivity goal we are working for in our current program planning, although, we need to achieve it long before the year 2000.

The first question the Baseline Report was designed to help address is, "What do we as a Nation want to buy?" Considering this question, the Baseline Report is a tool to help us make better informed policy decisions with increasingly scarce Federal resources and competing requirements. The alternative cases developed and estimated in the Baseline Report begin to shed light on what those alternatives would mean in terms of future policy decisions and estimated costs. The results of this year's Baseline Report indicate that future land use and development of new technologies will have the greatest long-term impact on costs.

We have other efforts underway, in addition to the Baseline Report, to support making more informed policy decisions, as well as improve the productivity of the Environmental Management program. For example, our current technology development efforts help us to better understand, in a more cost-effective manner, the type and extent of the environmental and safety risks at our sites. This information is a necessary first step in the process of remediating problems, such as dealing with plutonium in various forms and spent nuclear fuel rods. Technology development also addresses the major ongoing concerns and lessons learned from the past 5 years of Environmental Management program activities and from experience in the implementation of Superfund. These types of problems include the lack or inadequacy of existing technologies to remedy fully many of our complex environmental problems, the significant cost of some of these technologies, the lack of data available to characterize fully the risks; and the lack of consensus on standards for remediation.

The Environmental Management program is a prominent part of the Nation's science and technology development effort. As I mentioned, one of the challenges we face is the lack of available technologies for many of our contamination and/or waste management problems—a "technology/application" gap, if you will. The Department's National Laboratory system is a critical tool in developing newer, more effective, and cheaper environmental technologies to allow us to efficiently carry out our environmental projects. The Task Force on Alternative Futures for the Department of Energy National Laboratories released its report earlier this year, and I am happy that Bob Galvin and Henry Kendall are joining us today to discuss the task force's work. We agree with many of its findings and recommendations and have already begun to implement some of them. We have and will continue to use the laboratory system to the extent it can compete in producing useful results in a cost-effective manner, compared to other sources of research and technology.

MAKING PROGRESS

I would now like to highlight some of the Environmental Management program's accomplishments. These results not only demonstrate significant progress, but also reflect a new way of doing business by addressing urgent risks first while simultaneously managing the long-term contamination and health risks present at our sites. For example, in the last year we have addressed urgent risks in the following areas:

- Completed safety improvements to a building and begun to stabilize inventories of pyrophoric plutonium contained inside it at the Rocky Flats Plant in Colorado in fiscal year 1995. This material poses a fire hazard since, under certain conditions, plutonium ignites in air;
- Safely transferred 199 spent nuclear fuel elements to safer storage facilities in Idaho; and
- Returned 153 spent nuclear fuel elements containing weapons-grade uranium of United States origin from foreign research reactors. Accepting these fuel elements helps support the Nation's nuclear nonproliferation policy because they contain weapons-usable highly-enriched uranium;
- Began routine operation of a pump that has virtually eliminated the threat of explosion in a high-level waste tank at our Hanford site.

Since 1989, we have also reduced the backlog of accumulated waste and long-term contamination problems across the country. The Department's accomplishments include the following:

- Decommissioned approximately 100 facilities across the complex;
- Cleaned up 18 former nuclear weapons and industrial sites and 14 sites associated with uranium mining and milling;
- Remedited over nearly 5,000 public and private properties contaminated with uranium tailings;
- Treated 2.4 billion gallons of ground water and 1.8 billion gallons of surface water;
- Recycled 16 million pounds of scrap metal; and
- Safely transported roughly 1 million tons of hazardous materials in 140,000 shipments.

CHANGING THE WAY WE DO BUSINESS

These achievements demonstrate real progress in meeting our legal and moral obligations. However, inefficiencies still exist in our system, and there is room for more improvement. Given the downward trend in funding for the Department's Environmental Management program, we cannot afford to become complacent. To make up for this year's real budget reductions, and to continue to seize opportunities for increasing productivity, we must continue to be smarter about the way we operate through increasing efficiency and eliminating wasteful spending by hiring experienced Federal project managers, streamlining our contractor workforce, reducing indirect and overhead labor costs, and reforming our contracts. For example:

- We have hired 1,200 experienced project managers, cost estimators, safety and health professionals, and environmental engineers to provide greater accountability and oversight at our sites. In return for additional staff, field office managers have committed to specific productivity savings.
- We are reducing the number of contractor employees by a total of about 17,500—about 34 percent—from fiscal year 1994 to fiscal year 1996. We are downsizing our workforce in accordance with Section 3161 of the Defense Authorization Act of 1993 to mitigate adverse effects of such layoffs. The Rocky Flats Plant in Colorado and the Idaho National Engineering Laboratory are taking about 35 and 30 percent reductions of their total workforce, respectively; the Hanford Site in Washington and the Savannah River Site in South Carolina are reducing their workforce by 26 and 22 percent, respectively.
- We are recompeting and renegotiating our contracts to include greater incentives for outstanding performance and to ensure that the contractors—not the taxpayers—take on a larger share of the risks associated with doing business with the Department. A recently completed consolidation of our Idaho contract is projected to save $500 million over the next 5 years.

By instituting these changes, we believe that our program will be able to meet its legal commitments during fiscal year 1996, with a few exceptions. In cases where legal problems may occur we have already begun working with State regulators to resolve them within the fiscal year 1996 request level.

Our program will continue to be driven by a results-oriented, risk-based approach that seeks to address the most urgent public health and safety problems first. However, after this fiscal year, even with the continued productivity savings that are expected, there will be a gap between available resources and requirements in the future. In order to continue to meet our obligations, we will need to address these outyear challenges with new analytical tools, renegotiation of some of our compliance agreements, and statutory changes.

To help shape a smarter, more productive program, we are responding to several congressional requirements by developing analytical and informational tools:

- *As already described, the Baseline Environmental Management Report* was submitted to Congress on March 30, 1995. This is the Department's first attempt since 1988 to estimate the total life-cycle costs and schedules to complete its Environmental Management missions. It also examines the potential impacts on cost of several factors, including future land use, residual contamination standards, and technology development.
- *A Risk Report* requested by the Committees on Appropriations in DOE's fiscal year 1994 Energy and Water Development appropriation will be submitted to Congress in June. Although the Environmental Management program is making progress we realize a better understanding of the risks and how those risks are reflected in our compliance agreements is needed. This report presents an evaluation of the risks to the environment, workers and the public posed by Departmental facilities that are currently subject to compliance agreements.
- *The Environmental Management Annual Cost and Variance Report* submitted to Congress in March describes progress by the program across the country at our sites, including cost and schedule performance information.

With these tools we expect to improve our ability to plan the long-term future of the program.

COOPERATIVE EFFORTS TO INCREASE SUCCESS ARE NEEDED

The managerial initiatives are both bold and necessary to increase productivity, and the analytical tools we are developing and using to plan for a better future will reduce costs. But even these initiatives are not sufficient to ensure success. We still face a real reduction in budget relative to scope of work this year, and even deeper reductions in later years. Therefore, another way in which we are ensuring that we continue to meet our legal obligations is by working with regulators to make appropriate changes to compliance agreements and asking for appropriate changes in requirements that apply to the Department such as the Comprehensive Environmental Response, Compensation, and Liability Act or "Superfund" law.

Let me emphasize that the Department is committed to complying with the laws that apply to its sites and operations. If Congress appropriates the President's budget request the Environmental Management program will be in substantial compliance with its legal commitments in fiscal year 1996. Indeed, we have made real improvement in meeting our legal milestones in the past 2 years. In fiscal year 1993 75 percent of Environmental Management milestones were completed. For fiscal year 1994 and 1995 we are on track to complete 88 percent of our milestones, and in fiscal year 1996 we are projecting completing 95–97 percent of our milestone commitments. Notwithstanding that improvement many of our compliance agreements were signed during a fiscal climate much different from the one we have today. Some of the future milestones and schedules for completion are currently unworkable. Recognizing this, it is a reasonable, and indeed sensible, thing to do to work cooperatively with the States, stakeholders, and EPA to renegotiate those agreements as appropriate to align them more with current fiscal reality. Also, our goal in renegotiating these agreements is to ensure that they will achieve the greatest risk reduction and risk prevention per dollar spent.

COMPLIANCE AGREEMENT CHANGES

Changes are needed in our compliance agreements with regulators to address the systemic conditions that continue to hinder greater progress in the Environmental Management program. Given our future budget profile, it will be necessary to renegotiate some of the milestones in our current agreements. The Department will seek to accomplish the following in any new or renegotiated compliance agreements:

— Establish realistic timelines for milestones that are challenging but doable;

— Establish, ultimate end-point target dates, with appropriate intermediate objectives;

— Limit the enforceable milestones included in the agreement to a maximum of a 3-year timeframe to reflect sound technical planning assumptions, but allow for annual appropriations adjustments; and

— Provide that any and all penalties for noncompliance would fund further risk reduction.

We will continue to seek appropriate changes to our compliance agreements to better reflect budget realities and be able to address changing conditions at the sites. The Hanford Tri-Party Agreement was the first agreement renegotiated by the Clinton administration, resulting in more than $1 billion in savings. A second portion of the agreement is now being renegotiated to focus appropriate efforts on those risks of greatest concern to our stakeholders and make the cleanup more cost-effective. We are working with the States to effectively renegotiate our compliance agreements where necessary. We anticipate that by the end of June we will have a better idea whether this process will work.

In addition, changes in our budget cycle and the methods for setting enforceable milestones may be needed. In discussions with States we have proposed would allow for shorter-term milestones in our compliance agreements based on the lessons-learned after operating for several years under the current regime of multi-year milestone schedules. I would like to see compliance agreements with 3-year milestone timeframes, subject to annual appropriations changes, with longer-term milestones included as guidelines rather than enforceable actions. We hope to be able to accomplish this approach without the need for legislation. However, legislation that allowed 3-year budgeting cycle that paralleled the agreements would be desirable to provide more budget predictability to site and project managers.

LEGISLATIVE CHANGES

We currently recommend four areas of legislative change which we believe are vital this year in order to rationalize cleanups. First, the Superfund law needs changes to future take land use into consideration in cleanup actions and to establish universal standards for cleanup—standards based on sensible levels of risk given different future land uses.

Second, we support many elements of recently proposed risk legislation, and are working with the Congress to develop a sound and effective approach for such a risk analysis program. The Department also supports the inclusion of risks to workers as part of this legislation. The Department defined and published a set of principles for using risk analysis in January 1995. The principles are designed to be a first cut for the Department at defining risk analysis, its purposes, and the principles to be followed if it is to be done well and credibly.

Third, changes are needed to address the way budgets are allocated among our sites. For example, legislation to allow for site-based budgeting would help improve integration of operations at our sites, and allow them more flexibility in responding to changing environmental conditions and priorities. It would also allow a more tailored approach to risk reduction, letting the site managers and stakeholders determine what the greatest risks are at the individual site and how to prioritize activities based on cost-benefit analyses. We have proposed such a system on a pilot basis in our fiscal year 1996 budget request at the Rocky Flats site.

Finally, we should take another look at whether Federal officials should be exposed to the risk of criminal liability if a violation of environmental requirements occurs because of funding constraints where a good faith effort has been made to comply with the law.

The outlook for the Environmental Management program depends on many things. I have described the managerial changes we are implementing to address the challenges we face given declining resources. I have also outlined the focus on urgent risk reduction in prioritizing a results-oriented program. However, the scope of the Environmental Management program demands a national debate to help set priorities and directions for the future. Some of the issues that I believe we need to work on together include the following:

- We need to reconsider the pace and long-term schedule for the Environmental Management program. In 1989, the administration committed to a 30-year program. Now, preliminary analysis indicates that such a schedule is neither feasible nor wise. We need to consider carefully how to pace different aspects of the program. Our near-term goals need to address our urgent risks such as the Hanford waste tanks, spent nuclear fuel, and stabilizing nuclear materials and facilities to reduce maintenance costs. In addition, we need to invest in new technologies so that we have more effective and less costly remedies in the future. We need to think carefully about the risks and benefits of each alternative before selecting a particular course. In fact, the decision will not be a single one, but will be thousands of individual decisions based on the best information we can obtain on risks, costs, and schedules.
- We lack a rational and timely process to allocate funds in the event of a shortfall. I know that the Federal Facilities Environmental Restoration Dialogue Committee—the "Keystone" group in which the Department participated recommended in 1993 that a pro rata allocation be made among compliance-related budget areas for environmental restoration and related activities. First, environmental restoration activities are only one part of our budget and other activities such as waste management and facility stabilization need to be considered in the allocation of cuts. Also, although this process is appealingly simple, it does not take into consideration differences between sites such as efficiency, risk or opportunities to make progress.

With respect to the last point, we plan to take a step toward a more efficient budget allocation process this year. As stated in brief earlier, we proposed a pilot project at Rocky Flats to implement a site-based budget, rather than allocating funds through the traditional program organizational elements. The goal of this initiative is to provide sufficient flexibility to the site to ensure that funds are allocated to the highest priorities after the appropriation process is completed to address urgent risks or to make investments to reduce long-term maintenance costs. Site managers will be better able to work cooperatively with their local regulators and stakeholders to develop priorities that make sense for the site. These changes allow site managers to be more responsive to changing needs or site conditions, and avoids the cumbersome budget reprogramming process currently used. If this pilot proposal is approved and successful in fiscal year 1996 at Rocky Flats, I plan to expand this budget technique to all sites for fiscal year 1997.

In addition, we are exploring other options with respect to budgeting and priority setting that could help reduce total program costs and better focus technical expertise. These options are at the early stages of development, but could have the potential to dramatically change and improve how we conduct business, how much it costs, and how long it takes.

II. ANALYSIS OF THE ENVIRONMENTAL MANAGEMENT BUDGET BY PROGRAM AREA

The fiscal year 1996 budget request is being proposed under three separate appropriations accounts: the Energy Supply and Research Development appropriation (roughly 10 percent of the budget request); the Defense Environmental Restoration and Waste Management appropriation portion of the Atomic Energy Defense Activities account (roughly 87 percent of the budget request); and the Uranium Enrichment Decontamination and Decommissioning (D&D) Fund appropriation (roughly 3 percent of the budget request).

The Department's fiscal year 1996 budget request for the Environmental Management program totals $6,591,741,000. This includes $843,000,000 for new responsibilities primarily at three sites—Mound, Pinellas, and Savannah River—transferred to the Environmental Management account from the Defense Programs account. Management responsibility for the Savannah River Site, Mound, and Pinellas was transferred to Environmental Management in January 1995. Given a comparable work scope, this request represents a reduction of 4 percent from the fiscal year 1995 baseline appropriation. The information on the fiscal year 1996 budget request follows in Table 1.

TABLE 1.—ENVIRONMENTAL MANAGEMENT FUND SUMMARY

[Dollars in millions]

	Fiscal years		Percent change
	1995	1996	
Waste Management:			
Defense	$2,673.1	$2,501.6	−6.4
Non-Defense	243.0	206.1	−15.2
Total	2,916.1	2,707.7	−7.1
Corrective Activities:			
Defense	0.5	3.4	+580.0
Non-Defense	26.7	5.4	−79.8
Total	27.2	8.6	−67.6
Environmental Restoration:			
Defense	1,379.9	[1] 1,576.0	+14.2
Non-Defense	388.6	417.8	+7.5
Total	1,768.5,	1,993.8	+12.7
Uranium D&D Fund:			
Non-Defense	301.3	288.8	−4.1
Nuclear Material and Facility Stabilization:			
Defense	765.5	1,596.0	+108.5
Non-Defense	73.4	83.7	+14.0
Total	838.9	1,679.7	+100.2
Technology Development:			
Defense	417.4	390.5	−6.4
Transportation Management:			
Defense	20.7	16.1	−22.2
Compliance and Program Coordination:			
Defense	0	81.3	+100.0
Analysis Education and Risk Management:			
Defense	84.9	157.0	+84.9
Use of Prior Year Balances and Other Adjustments:			
Defense	−249.3	−313.9	+25.9
Non-Defense	−8.2	−23.1	+730.5
Total	−257.5	−337.0	+48.3
Transfer Government Contribution to Uranium Enrichment D&D from ER Defense/ Foreign Fees	−133.7	−395.0	+161.8
APPROPRIATION BREAKDOWN:			
Defense	5,092.7	6,008.0	+18.0
Energy Supply	723.5	689.9	−4.6
Uranium D&D Fund	167.6	−106.2	−163.4
TOTAL [2]	$5,983.8	$6,591.7	+10.2

[1] Includes $350 million for government contributions to the Uranium Enrichment D&D Fund Actual change from 1995 to 1996 for the Defense budget is −2 percent.

[2] This includes $843 million for newly transferred responsibilities The base budget request without these new responsibilities is $5.748 billion, a 4 percent reduction from last year's enacted amount

The Environmental Management program's budget is broken down into four primary activity areas. These are the first four shown in Table 1. The program also has Transportation Management, Compliance and Program Coordination, and Analysis, Education and Risk programs. The Transportation Management program, comprising less than 1 percent of the total Environmental Management budget, is responsible for the safe, secure, and cost-effective transport of Departmental materials, including hazardous and radioactive substances. The program also assures that all Department shipments comply with applicable regulations and operating procedures and guidelines. The Office of Compliance and Program Coordination, which accounts for about 1 percent of the total program budget, provides independent monitoring and appraisal, programmatic guidance, integrated performance analysis and technical assistance for the Environmental Management program's environment, safety, and health, engineering, cost evaluation, technical operations, transportation management, emergency management and other functions. The program-wide perspective of this office provides line organizations with an understanding of their implementation of applicable regulatory and technical requirements. The Analysis, Education and Risk Management part of the budget, approximately 2 percent of the total program, includes transfers of some former Office of Technology Development programs. Although a very small portion of the budget request, Analysis, Education and Risk Management supports essential activities such as analyzing current and long-term costs; formulating risk assessment and risk integration activities; developing policy; administering, formulating and executing the budget; conducting strategic, long-range planning; monitoring and evaluating contractor performance; conducting employee and public education programs; and providing links between the Department and other agencies, Congress, environmental and other stakeholder groups, and the private sector.

As we take on greater responsibility from other Departmental elements, we are requesting more funding for our Nuclear Materials and Facilities Stabilization program (formerly Facility Transition) which includes thousands of former Defense Program (DP) facilities that are no longer needed for nuclear weapons production. Significant funding is required to safely stabilize and maintain surplus nuclear weapons facilities while they await decontamination and decommissioning. Detailed breakouts of each of the four primary program areas appear below.

WASTE MANAGEMENT

BUDGET REQUEST: $2,716,551,000
37.0 percent of the total program budget

Major Activities

Waste management activities of the Environmental Management program comprise the largest portion—over a third—of the total budget request. (See Tables 2 and 3 for a breakdown of the Waste Management budget.) The program's activities include managing the treatment, storage and disposal of wastes, and working to minimize the amount of new wastes generated. The Department is faced with a variety of wastes, including high-level radioactive waste (such as the waste found in the Hanford tanks), transuranic waste, low-level radioactive waste, hazardous waste, and mixed waste (both radioactive and hazardous). The Waste Management program is also responsible for managing the Department's spent nuclear fuel. Some 2,700 metric tons of highly radioactive spent fuel is stored at various sites around the country. Some of the fuel is corroding, and some has been in storage for as long as 30 years—far longer than the planned storage time for this material.

In addition to maintaining safe storage the Department continues to operate treatment and disposal facilities while developing badly needed additional treatment and disposal capabilities. Examples of these projects include the Tank Waste Remediation System at Hanford, Washington; the Defense Waste Processing Facility and related high-level waste tank farm operations at the Savannah River Site, South Carolina; the West Valley Demonstration Project in New York; and the development of Site Treatment Plans with the 22 States where the Department stores or generates mixed waste.

Part of the waste management budget is funding for "corrective activities." In 1989, approximately 175 active and standby facilities were identified as being out of compliance with applicable local, State and Federal regulations. Corrective activities are conducted to bring these facilities into compliance as rapidly as possible. This portion of the budget has declined dramatically since 1991, when the appropriation was nearly $200 million, to this year's request of roughly $9 million. This declining budget reflects the success of this program in bringing the Department's facilities into compliance with applicable environmental regulations. For fiscal year 1996, only three projects under the Corrective Activities budget require funding for completion: the Hazardous Waste Treatment Facility at the Los Alamos National Laboratory, and two construction projects related to low-level radioactive waste at the Oak Ridge National Laboratory. Some of the environmental laws that the Department must comply with include the Resource Conservation and Recovery Act, the Clean Air Act, the Safe Drinking Water Act, and the Toxic Substances Control Act. These are the same laws that the government expects private industries to comply with to protect human health and the environment. Unless and until Congress amends these laws, the Department has a legal and moral obligation to comply with those laws and to request adequate funding to do so. This basic principle is codified in Executive Order 12088.

TABLE 2.—WASTE MANAGEMENT AND CORRECTIVE ACTIVITIES—Defense Funding Summary

[Dollars in thousands]

Activity	Fiscal years	
	1995	1996
Program Management	$184,113	$141,778
Facility Operations and Maintenance	1,236,258	1,178,891
Former Defense Program Facilities	62,060	171,085
New Facilities	708,786	566,040
Defense Waste Processing Facility	234,648	178,651
Hanford Waste Vitrification Plant	442	0
Waste Isolation Pilot Plant	174,323	172,700
Program Direction	72,417	92,451
TOTAL, Waste Management-Defense	$2,673,047	$2,501,596
CORRECTIVE ACTIVITIES		
TOTAL, Corrective Activities-Defense	$512	$3,406
TOTAL, Corrective Activities/Waste Management-Defense	$2,673,559	$2,505,002

TABLE 3.—WASTE MANAGEMENT AND CORRECTIVE ACTIVITIES—Non-Defense Funding Summary

[Dollars in thousands]

Activity	Fiscal years	
	1995	1996
Program Management	$4,242	$4,193
Facility Operations and Maintenance	71,191	63,290
New Facilities	34,979	10,562
West Valley Demonstration Project	125,127	122,100
Low-Level Waste	7,477	6,000
TOTAL, Waste Management-Non-Defense	$243,016	$206,145
TOTAL, Corrective Activities, Non-Defense	$26,700	$5,404
TOTAL, Corrective Activities and Waste Management, Non-Defense	$269,716	$211,549
GRAND TOTAL, Waste Management	$2,943,275	$2,716,551

Selected Accomplishments in Waste Management Fiscal Year 1994

In Idaho:

— Treated 700,000 gallons of liquid high-level waste to convert into a more stable, dry calcine form at the New Waste Calcining Facility.

In Nevada:

— Began shipments of low-level waste from Rocky Flats to the Nevada Test Site for disposal. Low-level waste has been accumulating at Rocky Flats since 1990 when the last shipments were made.

In New Mexico:

— Began the retrieval of bermed transuranic waste at Los Alamos National Laboratory to place in a compliant above-ground configuration.

In Washington:

— Reduced the volume of high-level waste in tanks at Hanford by 5.2 million gallons after treatment with the 242–A Evaporator system; and

— Completed the construction and began operating the Treated Effluent Disposal Facility at the Hanford site. This facility provides continuous treatment and disposal of liquid effluent from the 300 Area. All discharges of effluent to the 300 Area Process Trenches has ceased.

In New York:

— Completed the transfer and neutralization of acid high-level waste at the West Valley site in preparation of vitrification.

In Tennessee:

— At the Oak Ridge Reservation, we treated over 5 million pounds of mixed waste (both radioactive and hazardous) in 1994 at the Toxic Substances Control Act (TSCA) incinerator, exceeding both the requirements of the Oak Ridge Federal Facilities Compliance Agreement and the performance in 1993 which was 3.6 million pounds. These wastes originated from operations at our sites in Oak Ridge, Tennessee; Portsmouth, Ohio; and Paducah, Kentucky.

— Also at Oak Ridge, we treated 40 million gallons of wastewater at the K–25 Gaseous Diffusion plant's Central Neutralization Facility. This facility treats wastewater from the TSCA incinerator that contains radioactive and/or hazardous constituents in accordance with the National Pollution.

In South Carolina:

— At the Savannah River site, newly constructed low-level radioactive waste vaults began accepting waste. These vaults provide improved containment and protection of the area's relatively shallow water table, and represent the evolution of low-level disposal away from engineered trenches;

— After the restart of an evaporator system at Savannah River, over 1 million gallons of high-level waste was processed to reduce volume and create additional storage space; and

— Commenced radioactive operations of the In-Tank Precipitation facility and completed washing of Sludge Batch No. 1 at the Extended Sludge Processing Facility to prepare feed for the DWPF.

Priorities and Challenges for Fiscal Year 1996 in Waste Management

- Begin operations at the Defense Waste Processing Facility at Savannah River and at the West Valley vitrification facility.
- Finalize the EPA compliance plan for the Waste Isolation Pilot Plant in New Mexico.
- Continue to safely manage and treat approximately 61 million gallons of high-level radioactive waste stored in 177 underground tanks at the Hanford Site in Washington.
- Continue to improve management and storage of all DOE spent nuclear fuel while implementing decisions of the complex-wide Spent Nuclear Fuel Environmental Impact Statement.
- Implement Site Treatment Plans for mixed waste under the Federal Facility Compliance Act, and plan for the storage and disposal of treated mixed low-level waste.

ENVIRONMENTAL RESTORATION

BUDGET REQUEST: $1,993,731,000
27 percent of the total program budget

Major Activities

The Office of Environmental Restoration is responsible for the assessment and remediation of facilities and land no longer used for nuclear weapons production, as well as other inactive sites. These sites range from contaminated buildings to abandoned or inactive waste disposal sites. It is this portion of the overall Environmental Management program that is often described as the "cleanup" program.

Remedial action requirements are derived primarily from the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) and the Resource Conservation and Recovery Act (RCRA), and are carried out in compliance with the National Environmental Policy Act (NEPA).

The Formerly Utilized Sites Remedial Action Program (FUSRAP) and the Uranium Mill Tailings Remedial Action program (UMTRA) are also managed under the Environmental Restoration program.

We are continuing to move away from doing studies to engaging in actual cleanup. Almost 40 percent of the Environmental Restoration budget request for fiscal year 1996 will fund remediation—groundwater and soil restoration, and decontamination and decommissioning of facilities. A little over 15 percent of the budget request is for the Government Contribution to the Uranium Enrichment Decommissioning and Decontamination Fund, and a smaller portion is allocated for surveillance and maintenance activities, and landlord functions at the Fernald site and the Oak Ridge, Tennessee K–25 site. Most of the remaining budget is allocated to characterization and assessment of the nature and extent of environmental problems at our sites. In the coming years we will continue to devote even greater resources to environmental risk reduction and fewer resources to environmental assessments. (Information on the breakdown of the Environmental Restoration budget follows in Table 4.)

TABLE 4.—ENVIRONMENTAL RESTORATION FUNDING SUMMARY

[Dollars in thousands]

Subactivity	Fiscal years 1995	Fiscal years 1996
Defense:		
Facilities and Sites	$1,379,924	$1,575,973
Subtotal, Defense	$1,379,924	$1,575,973
Non-Defense:		
Facilities and Sites	$219,380	$244,758
Formerly Utilized Sites Remedial Action Project	74,100	85,200
Uranium Mill Tailings Remedial Actions Project	88,117	80,000
Uranium Mill Tailings Groundwater Restoration Project	7,000	7,800
Subtotal, Non-Defense	$388,597	$417,758
Uranium Enrichment D&D Fund	$301,327	$288,807
Total, Environmental Restoration*	$3,669,848	$2,282,538

*This total includes $288.8 million for the Uranium Enrichment D&D Fund. The total for Environmental Restoration programs without this fund is $1,993,731,000.

By the end of fiscal year 1996, we expect to have completed the remediation of almost 99 percent of the Uranium Mill Tailing Remedial Action (UMTRA) program's vicinity properties. As of now, we have cleaned up over 4,700 UMTRA vicinity properties, removing in excess of 2,400,000 cubic yards of contaminated materials.

The major activities of the Environmental Restoration program are as follows:

- At over 30 major DOE installations, safe management and remediation of contaminated sites, characterization, remedial action, decontamination and decommissioning, and closure activities.
- Formerly Utilized Sites Remedial Action Project (FUSRAP), which currently includes 41 former Manhattan Project or Atomic Energy Commission sites and five other sites added by Congress.
- Uranium Mill Tailings Remedial Action (UMTRA) Project, which conducts remediation of 24 inactive uranium mill tailings sites that provide uranium for past Manhattan Project and Atomic Energy Commission activities, as well as more than 5,000 associated vicinity properties.
- Uranium Mill Tailings Groundwater Compliance Project, which will restore, as necessary, the groundwater at the 24 UMTRA processing sites to ensure compliance with EPA standards.
- Uranium Enrichment Decontamination & Decommissioning (D&D) Fund, which provides for D&D, remedial actions, site-wide landlord requirements, and surveillance and maintenance efforts at the uranium enrichment facilities at Portsmouth, Ohio, and Paducah, Kentucky, and the inactive K–25 site at the Oak Ridge Reservation in Tennessee. This is also the source of funds for reimbursing a portion of the remedial action costs at active uranium and thorium mill sites as required by Title X of the Energy Policy Act of 1992.

Selected Accomplishments in Environmental Restoration

- 18 out of 46 Formerly Utilized Site Remedial Action Program (FUSRAP) sites (about 35 percent) have been cleaned up;
- 14 out of 24 Uranium Mill Tailings Remedial Action Program (UMTRA) sites have been completed, nearly 60 percent. Over 27 million cubic yards of mill tailings have been removed and disposed;
- 119 remedial action projects have been completed, with an additional 111 underway;
- 16 million pounds of scrap metal have been recycled; and
- 2.4 billion gallons of ground water have been pumped and treated and 1.8 billion gallons of surface water have been treated to reduce contaminants.

Priorities and Challenges in Environmental Restoration

In fiscal year 1996, the Environmental Restoration program will:

— Complete 100 interim cleanup actions, such as early removals and expedited responses;
— Complete 20 remedial action projects;
— Complete 12 interim decommissioning and decontamination actions;
— Complete 6 UMTRA cleanups and begin cleanup at the final 2 sites; and
— Complete 2 FUSRAP cleanups.

NUCLEAR MATERIAL AND FACILITY STABILIZATION

BUDGET REQUEST: $1,679,711,000

23 percent of the total program budget

Major Activities

The mission of the Office of Nuclear Material and Facility Stabilization is to reduce the high-risk conditions associated with unstable excess nuclear and chemical materials left intact at former nuclear weapons production facilities and reduce the maintenance costs associated with stabilizing buildings awaiting decontamination or final disposition. More specifically, this involves the protection of workers and environment from exposure and contamination, stabilization of hazardous nuclear and chemical materials, deactivation of facilities to attain the lowest surveillance and maintenance costs, and disposition of facilities to the Office of Environmental Restoration for decontamination and decommissioning.

With the end of the Cold War, a large amount of extraordinarily hazardous nuclear materials and a large number of facilities have become surplus and require stabilization prior to decontamination and decommissioning. These facilities typically require extensive surveillance and maintenance, as well as associated "landlord" activities such as utilities and fire safety functions. The Department will continue to incur costs for these activities until the nuclear materials are stabilized and removed. Approximately 4,500 facilities have already been transferred to the Environmental Management program for stabilization. Another 1,200 are expected between now and fiscal year 1999. Nuclear materials will require a variety of chemical processing activities, repackaging operations, and performing surveillance, maintenance, and safeguards activities. Surplus facilities, once stabilized, will require decontamination and decommissioning (D&D).

In fiscal year 1996, the Environmental Management program's responsibilities in the Nuclear Material and Facility Stabilization program area will double as the result of transferring the responsibility for Savannah River Site in South Carolina, the Mound Site in Ohio, and the Pinellas site in Florida from Defense Programs to the Environmental Management program, as well as approximately 18 high-risk facilities and 16 buildings supporting them at other sites in several States. These new responsibilities will include repair and operation of some facilities, stabilizing nuclear materials that pose a significant risk in their current form or location, producing radionuclides for Departmental missions, and developing new ways of operating complex facilities. This is the fastest growing program within the Office of Environmental Management. The carrying costs for these facilities are enormous and will continue to increase until the nuclear materials are stabilized and/or removed. The landlord responsibilities—including fire safety, utilities, roadway maintenance, and security—and surveillance and maintenance costs, for which the Office of Nuclear Material and Facility Stabilization is responsible, is in excess of $1 billion. Landlord responsibilities represent about 70 percent of the Office's budget.

Our budget request for Nuclear Material and Facility Stabilization reflects the overall strategy of the Environmental Management program to stabilize nuclear materials and facilities, recognizing that we cannot "cleanup" all of our facilities at once. Let me emphasize that this is one area in which inaction on our part could have serious near-term consequences on worker health and safety and the quality of the environment. Significant funding is needed to safely stabilize these facilities in order to reduce the cost and risks of maintaining the surplus facilities awaiting decontamination.

Our budget request for fiscal year 1996 includes funding for four principal sites:

- Savannah River Site, South Carolina. As of January 1995, the Environmental Management program became the primary site manager, or landlord, at Savannah River. The site budget request of $685 million in fiscal year 1996 is needed to safely conduct a range of operations. One urgent risk to workers at the site is the presence of nuclear materials in solution in the F-Canyon.
- Rocky Flats Plant, Colorado. $393.8 million is allocated for the program's operations, including the stabilization of 100 kilograms of pyrophoric plutonium, thus reducing the risk of fire. Also, the stabilization of about 375 gallons of acidic weapons-grade uranium liquids is planned.

- Hanford, Washington. Safe stabilization of plutonium with minimal worker exposure at the Plutonium Finishing Plant is planned, as is the removal of the remaining radioactive and hazardous chemicals from the PUREX facility to place the facility in a safe and stable, low maintenance condition, and to reduce out-year surveillance and maintenance costs. The funding request for fiscal year 1996 is $286.1 million.
- Idaho National Engineering Laboratory. We are working to stabilize uranium and liquid acidic solutions to significantly reduce out-year maintenance costs and have requested $162.1 million for fiscal year 1996. Leakage from aging pipelines could result in unsafe and costly contamination.

Additional Nuclear Material and Facility Stabilization site responsibilities include high risk facilities at:

- Los Alamos National Laboratory, NM; ETEC, CA; Oak Ridge, TN; Mound near Dayton, OH; and Pinellas, FL.

Information on the Nuclear Material and Facility Stabilization budget follows in Table 5.

TABLE 5.—NUCLEAR MATERIAL AND FACILITY STABILIZATION FUNDING SUMMARY

[Dollars in thousands]

Activity	Fiscal years	
	1995	1996
Defense:		
Program Integration[1]	$29,590	$63,299
Surveillance and Maintenance[2]	268,010	542,733
Deactivation/Compliance[3]	124,868	208,719
Landlord[4]	232,335	539,294
Program Management[5]	53,940	144,681
Program Direction[6]	56,774	97,302
Total Defense	$765,517	$1,596,028
Non-Defense:		
Program Integration	$1,200	$2,916
Surveillance and Maintenance	54,313	40,217
Deactivation/Compliance	17,823	40,550
Subtotal, Non-Defense	73,336	83,683
Total, Nuclear Materials/Facility Stabilization	$838,853	$1,679,711

[1] Program Integration refers to planning, site characterization, and other activities associated with assuming management responsibility for a site.

[2] Surveillance and Maintenance refers to periodic inspection of items such as HEPA filters, tank levels, and waste drum conditions to ensure safe operations of the facilities

[3] Deactivation/Compliance refers to activities associated with the removal of hazardous and radioactive material, equipment, etc., to reduce the hazard classification of the facility

[4] Landlord refers to activities that cut across an entire site, such as medical and fire-fighting services, electricity, sewer, and water.

[5] Program Management refers to contract support directly related to Nuclear Material and Facility Stabilization

[6] Program Direction refers to salaries and other direct costs of Federal employees.

Selected Accomplishments of the Nuclear Material and Facility Stabilization Program

At Rocky Flats, Colorado:

- Initiated shipment of low-level waste generated at Rocky Flats to the Nevada Test Site and continued shipments to Hanford;
- Completed renegotiation of interagency agreement with the State of Colorado and the Environmental Protection Agency; and
- Completed solidification of 375 bottles of dilute plutonium solutions.

At Richland, Washington:

- Completed deactivation of the Uranium Tri-Oxide plant;
- Reduced the contaminated area of PUREX by 420,000 square feet, approximately 90 percent of the total area; and
- Remediated the plutonium bearing ductwork in support facility at the Plutonium Finishing Plant.

At Idaho National Engineering Laboratory, Idaho

- Completed the uranium accountability at the Idaho Chemical Processing Plant's Buildings 601 and 602, part of the facility's uranium recovery line;

- Completed the deactivation of the second and third cycle extraction processes at the Idaho Chemical Processing Plant (ICPP); and
- Completed the deactivation of the ICPP denitrator process stabilizing 12,000 liters of liquid uranium inventories.

Priorities and Challenges for Nuclear Material and Facility Stabilization

At Rocky Flats, Colorado:

- Thermally stabilize 100 kilograms of pyrophoric plutonium oxides to eliminate the risk of fire;
- Convert 1,400 liters of nitrate solutions comprising 275 kilograms of 93.2 percent highly enriched uranium to a solid form; and
- Complete filtered venting of 2,000 drums containing plutonium materials to prevent explosion and possible failure of containment.

At Richland, Washington:

- Complete 78 percent of the Plutonium-Uranium (PUREX) deactivation project;
- Disposition 947,000 liters of surplus uranium contaminated nitric acid; and
- Complete 75 percent defueling of the Fast Flux Test Facility (FFTF) reactor.

At Idaho National Engineering Laboratory, Idaho:

- Initiate deactivation of the Idaho Chemical Processing Plant dry end process including removal of up to 150 kilograms of uranium in graphite ash; and
- Complete definitive design for deactivation of calcine cell within the Old Waste Calcining Facility.

At Savannah River, South Carolina:

- Complete stabilization of 300,000 liters of plutonium 239 solutions in F Canyon; and
- Complete the stabilization of 1,600 liters of Pu-242 solutions and 16,000 corroding plutonium targets pending completion of the Interim Management of Nuclear Materials Environmental Impact Statement.

TECHNOLOGY DEVELOPMENT

BUDGET REQUEST: $390,510,000
5.3 percent of the total program budget

Major Activities

Developing new technologies to address the environmental challenges in the former nuclear weapons complex is an integral part of the Environmental Management program. This program also reflects our strategy of investing in technology development to develop long-term effective methods for addressing environmental challenges. The goals of our technology development program include reducing risks to people and the environment, reducing cleanup costs, and finding new technologies to environmental problems for which no solutions currently exist. The Environmental Management Technology Development program is an aggressive national program of applied research, development, demonstration, testing, and evaluation for environmental cleanup, waste management, and related technologies. Our strategy is to identify and develop technologies that can clean up the nuclear weapons complex, and manage the wastes more quickly, more safely and at a lower cost. In many cases, developing new technologies presents the best hope for ensuring a real reduction in risk to the environment and improved worker and public safety, especially given competing national priorities and limited funds. (The Technology Development budget follows in Table 6.)

TABLE 6.—TECHNOLOGY DEVELOPMENT FUNDING SUMMARY

[Dollars in thousands]

Subactivity	Fiscal years	
	1995	1996
Defense:		
Treatment and Remediation Technology Systems	$157,118	$203,800
Innovative and Crosscutting Technology Program	80,229	80,200
Industry Programs	43,200	41,200
Technology Integration	9,789	17,040
Program Support	38,054	33,271
Program Direction	16,754	14,999
Education and Integrated Risk Management Initiative	38,752	0

TABLE 6.—TECHNOLOGY DEVELOPMENT FUNDING SUMMARY—Continued

[Dollars in thousands]

Subactivity	Fiscal years	
	1995	1996
Infrastructure Program	32,863	0
Total, Technology Development	*417,359	390,510

*This includes Education and Risk Management Initiatives and Infrastructure Programs These programs have been transferred to other Environmental Management organizations for fiscal year 1996. The base budget for fiscal year 1995 is $336 5 million

Selected Accomplishments in Technology Development

In Texas:

- The Expedited Site Characterization methodology saved $3 million and 6 months in characterizing parts of the Pantex, Texas, site. It also provided a more comprehensive site analysis than would have been possible with baseline technologies.
- Five new applications of technologies developed saved over $28 million and, in one case, decades of treatment. (See California example below.)
- Decisions have been signed with private industry for three remediation projects using new technologies: Minimum Additive Waste Stabilization (MAWS) at Fernald, Robotic Retrieval and Vitrification at Idaho, and MAWS at Savannah River. These applications will save over $80 million over baseline technologies. In total, over $115 million have been saved through the use of new or improved technologies.

In Tennessee:

- We demonstrated a Laser-Induced Fluorescence (LIF) sensor system for the detection of uranium at the now closed K–25 gaseous diffusion uranium enrichment plant at the Oak Ridge site. This real-time sensor is capable of detecting uranium on surfaces through laser excitation of the oxide. Uranium was detected on the surfaces of gaseous diffusion chambers inside the building of K–25 as well as on the rooftops and vent stacks. For decontamination and decommissioning activities, where alpha particle detectors are currently being used to screen for uranium, the LIF system offers the potential of reducing first-order screening time to less than 10 percent of current requirements.

In California:

- At Lawrence Livermore National Laboratory, we demonstrated the use of dynamic underground stripping, a system for thermal remediation of an underground gasoline spill. Underground imaging techniques were used to verify remediation efficiency and to detect the presence of free gasoline, if any. Over 30,280 liters of gasoline have been removed, at an estimated cost of $65 per cubic meter, versus a typical pump and treat cost of about $260 per cubic meter. The time for remediating with a pump-and-treat system is in terms of several decades, while the dynamic stripping is in terms of several months. The baseline technology, pump and treat, costs $25 million and takes 30 years; dynamic stripping costs $6 million and takes only 6 months saving $19 million and decades. The University of California is seeking commercialization opportunities.

In South Carolina:

- At the Savannah River Site, we successfully demonstrated in-situ air stripping. This new technology, which involves injection of air through underground horizontal wells to strip groundwater and soils of volatile organic chemicals, will be transferred to the Environmental Restoration program and to private industry for use.
- Also at Savannah River, Fiber Optic Chemical sensors have been used to allow on-the-spot monitoring of chlorine in waste streams and groundwater. This allows real-time analysis rather than normal week-long laboratory analysis. Non-exclusive licenses for Trichloroethylene sensors have been issued with Purus and Burge Instrument Company in New Mexico:

In New Mexico:

- The Long Range Alpha Detector was implemented at the Los Alamos National Laboratory. This instrument measures alpha radiation in air molecules in real-time and on large surface areas. Preliminary costs estimates indicate that LRAD saves from $10 to $20 thousand per site surveyed compared to conventional technologies. Up to 30 sites can be monitored in a day without disturbing soil or generating waste. This technology was transferred from Los Alamos to TMA/Eberline via a Cooperative Research and Development Agreement.

- The Magnetometer Towed Array measures magnetic forces, allowing buried hazardous wastes—particularly ferrous metals—to be located. Up to 15 acres a day can be surveyed, more than 7 times the capability of conventional technologies. It also costs about $2,000 per acre to use versus $3,500 to $5,000 with conventional methods. Sandia National Laboratory developed this technology, and transferred it to Geo-Centers, Inc.

Priorities and Challenges in Technology Development

Some major priorities and challenges for Technology Development include:

- Treat and dispose of mixed wastes. We are pursuing versatile treatment methods such as plasma, vitrification, molten metal and non-thermal techniques. These activities are being closely coordinated with the Waste Management program to meet Federal Facility Compliance Act requirements.
- Retrieve and process tank waste. We are initiating full-scale demonstrations on technology systems to safely retrieve and efficiently process high-level tank waste for permanent disposal. Tank structural analysis and waste content analysis methods are being developed.
- Remediate contaminated soils and groundwater. We have initiated full-scale demonstrations on technology systems to characterize, contain, and remediate contaminated plumes in soils and groundwater. In-situ treatment of Dense Non-Aqueous Phase Liquids (DNAPLs) is one example.
- Stabilize landfills. Containment and in-situ treatment methods for buried waste are being developed. In addition, the retrieval, characterization and treatment of landfill wastes are being pursued.
- Recycle materials from decontamination and decommissioning of facilities. We will conduct a full-scale demonstration for the development of facility decontamination and decommissioning technologies with emphasis on the recycling of materials.
- Transfer technologies to private industry. As part of the Secretary's emphasis on measuring results, we have committed to making a minimum of 24 technologies available for transfer to private industry and to Federal facilities. By successfully transferring these technologies, the Nation can achieve a return on the investment in technology development.

This concludes the description of our specific program areas. In the next section, I will describe our program's strategic goals and highlight the progress we have made.

III. STRATEGIC GOALS: INITIATIVES AND PROGRESS

Over, the past year, the Department has made significant progress in fulfilling its goals for improving the Environmental Management program. In 1993 I established six strategic goals to guide our efforts.

(1) Manage, and eliminate the urgent risks and threats in our system;

(2) Provide a safe workplace that is free from fatalities and accidents, and that continuously reduces injuries and adverse health effects;

(3) Change the system so that it is under control managerially and financially;

(4) Become more outcome oriented and get more results on the ground in a timely fashion;

(5) Focus the technology development program on DOE's major environmental management issues while involving the best talent in the DOE and the national (public and private) science and engineering communities; and

(6) Develop strong partnerships between the Department and its stakeholders.

We are dedicated to meeting the strategic goals we have set for the Environmental Management program, despite fiscal constraints. In fact, focussing on these strategic goals and priorities is even more critical in the face of funding constraints. However, we must all do our jobs more efficiently and effectively to meet the increasing amount of work we face. I would like to highlight some of our recent achievements in these six areas.

REDUCING URGENT RISKS

Two of our most urgent safety concerns have been addressed. A unique mixing pump installed in the SY–101 high-level waste tank at Hanford has begun routine operation after previous experimental use. This pump has virtually eliminated the danger of an explosion in this tank. Also, the threat of fire from unstable inventories of plutonium has been greatly reduced at Rocky Flats since beginning stabilization processes there.

In addition to these high-priority risks, our spent nuclear fuel management program continues to improve the storage conditions of this highly radioactive material. Nearly 200 spent fuel elements were recently transferred to safer storage conditions at our Idaho site, and we continue to upgrade the facilities that store this highly radioactive material.

We are committed to continued risk reduction. The Department has hundreds of high-level waste tanks and some continue to pose some risk of explosion. Though the installation of the mixing pump in our most troublesome tank has been successful, we must continue to mitigate risks in the other storage tanks. Also, we have only begun to stabilize the plutonium inventory at Rocky Flats that poses a fire hazard. Some 100 additional kilograms need to be stabilized to eliminate the risk of a plutonium fire. We are committed to seeing this project through as quickly as possible. Furthermore, the continued improvement of our spent nuclear fuel storage facilities is a priority. We have made progress in this area, but more needs to be done. We are determined to see that these materials are stored in a safe, secure manner to enhance worker and public safety as well as support the Nation's nonproliferation goals.

As noted earlier in my testimony, the Department has published and adopted a series of risk principles to guide the setting of priorities for the Environmental Management program. These principles, which were developed as a result of efforts led by the Office of Science and Technology Policy, will be used across the Federal Government, including applying sound risk analysis procedures to regulatory decisionmaking. As a regulated agency, not a regulator, the Department modified administration's principles to apply more specifically to its programs and procedures, to accommodate our citizens' values, to address inter-generational issues, and to clarify the role of prevention programs and social and economic considerations in risk management.

PROTECTING WORKER'S HEALTH AND SAFETY

Far too often, worker protection and safety have taken a back seat in the Department's corporate culture. This is no longer the case. Our second strategic goal helps ensure that the people who carry out the heart of the work of our program are protected from the risks they may face. Through continuing vigilance and close cooperation with our contractors, last year the Department reduced the amount of work days lost due to injury by 12 percent.

We will continue to train thousands of workers through sponsorship of a Hazardous Waste Operations and Emergency Response (HAZWOPER) program in cooperation with the National Institute for Environmental Health Sciences. This training is essential for the safe conduct of operations within Departmental treatment, storage, and disposal facilities and hazardous waste sites, and is required by the Occupational Safety and Health Administration for workers who enter and work in these areas.

GAINING FINANCIAL AND MANAGERIAL CONTROL

Contract Reform

The Department's contracting system fulfilled the Nation's Cold War priorities of designing, building, and testing nuclear weapons secretly and quickly. When production was the primary mission, one large contractor was responsible for services at each site, and that contractor was protected virtually all from most financial risks by the terms of the contract.

While appropriate for Cold War production, these types of contracts are not the best way to reach the environmental quality objectives of the Department today. We will require contractors involved in environmental management activities to demonstrate sound business practices and assume greater financial responsibility for activities within their control.

Contract reform initiatives emphasize competition and the development of clear, objective performance criteria and measures. Performance-based incentives are focused on the accomplishment of the Department's strategic mission and reward contractors for fulfilling clear programmatic objectives. The Department has also begun to reallocate the financial and legal risks inherent in operating its sites in order to hold contractors more accountable.

Currently, nearly $30 billion worth of contracts are being renegotiated and recompeted. A recent example of how the Department is changing its contracting arrangements is the consolidation of contracts at the Idaho National Engineering Laboratory. This consolidation is projected to save over $500 million over the next 5 years. It is also notable in that the contractor assumes a greater and more appropriate share of the financial risk for inadequate performance.

This process is just getting underway, and will take time to complete. However, it is well worth the effort to create a contract regime that is better-suited to our mission and will save billions of dollar.

Improved Contract Management

Compared to other Federal agencies, the Department of Energy has the highest ratio of contractors to Federal employees. We cannot gain managerial control of this program until we have the personnel to help us do that. The Department has been working closely with the Congress and the Office of Management and Budget to allow for greater flexibility within the authorized budget to hire more Federal workers to shift this ratio. New cost estimators and project managers have already been hired to improve the efficiency of projects and quickly identify cost needs and opportunities for savings. Overall, 1,600 new Federal employees, including project managers and cost estimators, have been authorized for the program since fiscal year 1994 and 1,200 will be hired by March 1995. These new managers will primarily be located at our field sites, rather than in Washington, D.C.

As I mentioned before, we must downsize our contractor workforce substantially to bring workforce structure and size in line with new missions and management arrangements. These contractor workforce reductions are also necessary for improved productivity and cost savings.

New Initiatives for Budget Allocation

There are opportunities to better manage our money and achieve savings. Given the uncertainty of annual budgets, and the varying scope of work the program is responsible for, flexibility in budget allocation is essential to meet our program goals.

As I mentioned earlier, a new approach to budget allocation is proposed for this year. In fiscal year 1996, at the Rocky Flats site, we are proposing a pilot budget process that will allocate funds to the site as a whole, rather than be divided along Environmental Management programmatic lines (such as environmental restoration, waste management, etc.). This will allow site managers to more quickly and effectively direct funds to the most urgent risks they face and to be responsive to changing conditions or new information about risks at the sites rather than having to go through the cumbersome exercise of reprogramming funds currently done at headquarters. Additionally, the site manager will be better able to engage regulators and other stakeholders to develop priorities that make sense for the site. It also increases the accountability of site managers to National Program Managers, to Congress, and to the regulators.

This pilot program holds much promise to reinvent budget allocation and improve risk management. Though only a preliminary program this year, we plan to expand the concept to all of our major sites in fiscal year 1997 if it proves successful.

DEMONSTRATING TANGIBLE RESULTS

The Environmental Management program is committed to showing tangible progress in all of its activities. Already I have highlighted the achievements of the program since its inception, at particular sites, and by program area. The progress we have made is significant, but the challenges we face continue to mount. Thus, we must continue to set goals for progress in order to guide our efforts and address priorities. Let me share with you some of our immediate plans for the coming year.

Some of the key outcomes of the Environmental Management program planned for fiscal year 1996 include:

- Complete the stabilization of the current plutonium oxide inventories at Rocky Flats, eliminating the risk of a plutonium fire;
- Transfer over 500 additional spent fuel elements to safer storage conditions in Idaho and Washington, thus protecting workers and the public from these highly radioactive substances;
- Demonstrate 50 new or improved environmental cleanup and/or characterization technologies to help reduce costs and increase the effectiveness of our work;
- Complete 100 interim environmental restoration actions, 20 larger-scale cleanups, 12 interim decommissioning and decontamination actions, and complete 2 more Formerly Utilized Sites Remedial Action Program (FUSRAP) projects;
- Begin operation of the Defense Waste Processing Facility in South Carolina and the vitrification plant at West Valley, New York, to convert liquid high-level waste into stable glass logs; and
- Finalize the Waste Isolation Pilot Plant compliance application for EPA approval, an important milestone for the Department's transuranic waste repository program.

It is my sincere hope and intention that, given adequate resources for our program, I can report back to you next year, as I am this year, and tell you that all of these things, and more, have been achieved.

DEVELOPING MORE EFFECTIVE TECHNOLOGIES

Beginning in 1993, the Environmental Management program established the goal of "focusing" technology development efforts on our most critical needs to assist in the missions of environmental quality. Five "focus areas" were created in 1994 to guide this effort. This "focusing" has been achieved and we are now engaged in developing and implementing new technologies and methods of environmental characterization and remediation to get results. Considering initial analysis that points to the Environmental Management program requiring several decades—or more—to complete its work, the need for basic research is also clear.

The five focus areas, and some examples of progress, include the following:

- Mixed waste characterization, treatment, and disposal. Our Idaho National Engineering Laboratory leads the programs to address treatment, destruction, and disposal of mixed wastes. Two of these, vitrification of mixed waste sludge and the encapsulation of nitrate salt waste in polyethylene, have been demonstrated in pilot projects. These activities will be closely coordinated with the Office of Waste Management to meet Federal Facility Compliance Act requirements.
- Radioactive tank waste remediation. Led by our Richland, Washington office, this program addresses the urgent problems associated with the storage of millions of gallons of high-level radioactive waste. Characterization, leak detection, retrieval and processing of the tank wastes for final disposition are key areas of this effort. By June 1997, the goal is to demonstrate the ability to retrieve and treat liquid tank waste to comply with the Hanford Tri-Party Agreement.
- Contaminant plume containment and remediation. Over 600 billion gallons of ground water and 200 million cubic yards of soil are contaminated with radioactive and hazardous materials. Our Savannah River Site in South Carolina heads up this focus area. The goal of this focus area is to prevent further spread of contaminants and remediate the ground water and soil contamination.
- Landfill stabilization. Also coordinated by the Savannah River Site, this focus area is aimed at remediating landfills and contaminated soils associated with over 3 million cubic meters of radioactive and hazardous buried waste, and other types of landfilled waste.
- Facility transitioning, decommissioning final disposition. The Department is responsible for deactivating and dispositioning 1,200 facilities across the Nation. The vast majority of surplused facilities are expected to be transferred to the Environmental Management program. The Morgantown Environmental Technology Center in West Virginia leads in the development of methods to decontaminate structures at lower cost to the taxpayer.

For fiscal year 1996, our Technology Development program plans to demonstrate 50 new or improved environmental technologies. Furthermore, 24 technologies will be transferred or made available for transfer to our operating programs, other Federal facilities, and the private sector.

Last year, we announced a new approach to managing our environmental research and technology development activities. The goal of this new approach is to conduct a research and technology development program that involves the best talent in the Department and the national science communities to focus on developing environmental surveillance and remediation technologies to efficiently clean up our sites.

Key features of this new approach include teaming up with our Waste Management, Environmental Restoration, and Nuclear Materials and Facilities Stabilization programs to identify, develop and field test needed technologies for these programs; continuing to use a life-cycle approach to technology development, involving high-level management across the Department; focusing technology development activities on solutions to major environmental management problems; focusing all available resources in national laboratories more effectively; involving industry in developing and implementing solutions including both technology transfer into the Department and technology transfer from DOE to the private sector; strengthening basic research by involving academia and other research organizations to stimulate technological breakthroughs; enhancing mechanisms for regulator and stakeholder involvement; and applying business principles such as avoiding unnecessary costs, getting a return on investment, and quickly transferring technologies to the marketplace.

We are involved in a number of efforts to develop new technologies. First, of course, are the variety of efforts at the national laboratories. These institutions have some of the best technical talent and facilities in the world, and are now available for conversion from their previous defense missions. However, we will continue to seek the most cost-effective source of research and development rather than rely solely on an internal, Departmental system. Second, we are participating on a Federal Advisory Committee to Develop On-Site Innovative Technologies (DOIT) with several western governors, senior representatives from the Department of Defense and Interior, the Environmental Protection Agency, and ex-officio members of the Western Governors Association and the Office of Management and Budget.

PUBLIC PARTICIPATION AND ACCOUNTABILITY

Our Nation's nuclear weapons operations were conducted in secrecy over a period of 50 years, which while necessary during the Cold War, resulted in distrust of the Department's ability to restore, stabilize, and clean up the environmental legacy left behind. Secretary O'Leary's openness initiative beginning in December 1993 recognized the credibility problems the Department faced and its impact on our ability to do our job. We have learned that building trust is essential to the success of the Environmental Management program—for negotiating agreements, obtaining permits, and achieving public consensus. Following the Secretary's initiatives on openness and involving the public in our decisionmaking, I established the Office of Public Accountability in 1993. This office is responsible for ensuring that all Environmental Management offices conduct substantive, cooperative planning with all our stakeholders in the development and implementation of budgets and policies. This mechanism allows the people who live and work in and around our sites to understand what we are doing and why, and affords them the opportunity to engage in the process. Our personnel in the field are receiving training on public participation, and in a short time, this office has taken major strides to actively involve the public in meaningful ways:

- We are continuing with an aggressive schedule that follows the recommendations of the Keystone process to involve stakeholders in key decisions through site-specific advisory boards (SSABs) at our major sites. We currently have SSABs in place at Fernald, Hanford, Rocky Flats, Idaho, Nevada, and the Savannah River Site. Three additional SSABs are in the final stages of forming.
- Through the State and Tribal Government Working Group (STGWG), the Department provides a forum for six tribes and 17 States to share their concerns with us and provide input to the various sites around the country.
- The Environmental Management Advisory Board (EMAB) involves representatives from labor, the U.S. Environmental Protection Agency, tribes, States, and citizen groups in a variety of issues facing the Environmental Management program. The EMAB was recently reconstituted, and now has 28 members.
- We are also committed, in accordance with Executive Order 12898 on environmental justice, to working with those individuals and groups around our sites who may consider themselves to be disenfranchised. For example, we are working to ensure that the Native American communities around our sites are responsibly included in all of our regulatory negotiations.

IV. CONCLUSION—REMAINING CHALLENGES BEFORE US

The Department of Energy has undergone significant changes and faced difficult challenges over the past few years. Since the end of the Cold War, the Department's primary mission has changed from that of producing nuclear weapons to addressing the consequences of a half-century of nuclear weapons production, testing, and research. We are applying our technical and scientific expertise on other endeavors to expand our knowledge and support the national economy. The Secretary has led the momentous effort in making our Department more open to facilitate meaningful public awareness and participation in national policy decisions. These institutional and fundamental cultural changes within the Department cannot happen overnight. We believe that we are on the right track and have been effective in making fundamental changes in the way the Department does business.

The Environmental Management program has been integrally involved with these Departmental changes. Openness, focus on a new mission, new motivations, and accountability are characteristics that the Environmental Management program has attempted to develop, and will continue to nurture. Coupled with our strategic goals, the Environmental Management program is dedicated to meeting its responsibilities in reducing risks, creating a safe work environment, and protecting public safety.

Our proposed fiscal year 1996 budget for the Environmental Management program is a declining budget given an equal work scope but it will still allow us to fulfill legal and moral commitments while simultaneously streamlining our program. This streamlining, however, has limits beyond which further cuts in funding will trade off savings against safety. We are engaged in a daunting effort to redirect the national commitment from production of nuclear weapons for our national security strategy to resolving the resulting widespread environmental and safety problems at thousands of contaminated sites across the country. We have an obligation to do no less and we are dedicated to producing meaningful results.

Thank you.

Senator KEMPTHRONE. Secretary Grumbly, thank you very much. I appreciate your comments.

Let me turn to Mr. Galvin for your comments, please.

STATEMENT OF ROBERT W. GALVIN, CHAIRMAN, EXECUTIVE COMMITTEE, GALVIN TASK FORCE ON ALTERNATIVE FUTURES FOR THE DEPARTMENT OF ENERGY NATIONAL LABORATORIES, SECRETARY OF ENERGY ADVISORY BOARD

Mr. GALVIN. Thank you very much, Mr. Chairman, ladies and gentlemen.

I come here, briefly, to foster the committee in relationship to the work of Mr. Grumbly and members of our committee such as Henry Kendall. My comments will be brief. I have no opening comments to submit. The invitation to participate here did reach me at a rather recent moment, and I did not have a chance to otherwise present written material, which I have incidentally, sir, on literally six other occasions to the House and/or to the Senate on a variety of things.

I will limit also my comments to the specific subject matter of this particular panel. I, simply, account to you that the Secretary appointed all of the members of our committee, and we came to our role of suggesting alternative futures in, and retained that role of being, in effect, partners of the rest of the citizens of this country to help achieve a better and constructive contribution by the laboratories.

As we introduced ourselves to our responsibilities with regard to the subject of your hearing, here were some of the general things that we picked up from each of our visits to almost all of the laboratories: one was that the remediation issue was, indeed, a very significant issue. Frankly, most of the members of our panel were members of high credentials in science such as Henry Kendall, myself excepted. They knew that in general, but did not realize it in the increment. Second, that it appeared that the policies that were being invoked upon the system, the systems here involve the Congress, to begin with, and the Department.

Certainly, all of the constituencies—the neighbors, the communities, et cetera, the laboratories and all—that the policies that had been unfolding over the last few years appeared to be a set of policies that had, in effect, a principle that we dare not take any risks. We just have to go clean up everything instantly. I am using simple layman language on that.

As a consequence, the kind of compliance agreements that Tom has just referred to, apparently became quite numerous. At the same time, it appeared that people were having to use whatever was the available technology. As we proceeded to meet with all of the experts at the various laboratories, they would say to us, in general, and in many cases particular—as Henry can account for and as the subcommittee can account for—that there were all kinds of potential opportunities to have better technology to resolve our problems, if we would take a studied risk and then come around and apply the right technology, when we truly could do a better job of cleaning things up.

It was in this environment and with this generalization that we arrived in our committee about, I would say, June of last year, after we had gone through this 3 or 4 months, that this appeared to be the nature of our issues. We did not start this committee with an intention of having a subcommittee on just the issue of remediation.

When we discovered that this was a paramount issue, then in the course of our organizing—and we did organize ourselves into a batch of subcommittees because the problem was such a vast one—and then we iterated it with each other in plenary sessions. We asked a small group of people led by Dr. Kendall to take a look at this situation.

As in the case of all of the subject matter, each of us had certain skills and/or certain interests. Henry's was clearly one of those that was in this interest. I do defer to his subcommittee's detailed knowledge of this subject, which is substantially greater than mine.

I would like to say, in conclusion, that I think that this country is much benefited by the citizenry of the Tom Grumblys who literally take on, in my estimation, almost thankless task to take on this kind of inherited problem with all its difficulties, wherever we may have some differences as to what technically ought to be done. I see in the personnel of the Department a great sincerity to resolve the issue.

Finally, I would just say this, sir. As you look to the resolution of these problems, I hope you will not be afraid to look in the mirror. A good deal of the system's problems are derived from the policies that come from the Congress. I do not know them in detail in this particular area, but they were certainly true in a lot of other things that we have dealt with. It is a systems problem that has to do with the policies that follow from yourselves and your relationship with your administration associates. We, simply, pointed out that there are great promises of going at the job better than had been done some years prior. Thank you.

Senator KEMPTHORNE. Mr. Galvin, thank you very much. I agree with you. We are very fortunate that Mr. Grumbly is in this current position. Also, I note in your report that on a variety of occasions you have pointed out that many of these decisions must be political decisions, not technological decisions.

Dr. Kendall, we look forward to your comments.

STATEMENT OF DR. HENRY W. KENDALL, CHAIRMAN, ENVIRONMENTAL MANAGEMENT PROGRAMS SUBCOMMITTEE, GALVIN TASK FORCE ON ALTERNATIVE FUTURES FOR THE DEPARTMENT OF ENERGY NATIONAL LABORATORIES, SECRETARY OF ENERGY ADVISORY BOARD

Dr. KENDALL. Well, let me start by expressing my appreciation for the invitation, one I am pleased to accept. As in Bob Galvin's case, the time was a little short and it was suggested that the written material, which I had time to prepare only a little of, address primarily the Department of Energy's response to the Task Force, Galvin Task Force, Section Chapter 4 on the Department of Energy's Environmental Management (EM) program, and that is what it contains. I think this does not represent a major defect, because you are clearly very much aware of the Task Force report and its Chapter 4.

That chapter sets out our views of the EM program. It represents work that really got up to speed, as Bob indicated, in June of last year. I was on one other subpanel, the National Security Subpanel chaired by Bill Spencer from Sematech—and that group got extensive briefings and site visits on matters connected with EM activities, as well as looking at national security issues, which of course was their main charge.

A summary of Chapter 4, on EM programs, is that we found a number of disconnects in the program having to do with, first, the science engineering and applications. We felt that the level and quality of science was not as high as it should be, and appeared respectively not to be improving much. This appears to be improving somewhat since the panel report was put together. I hope it continues to improve, because it represented a fairly significant defect.

There are problems—and Secretary Grumbly has touched on them—of regulatory oversight and compliance. It is certainly the case that many of these compliance agreements that the Department of Energy signed inflict extraordinary burdens on the Department. I absolutely agree and can give many examples of portions of those compliance agreements which simply cannot be met.

I do not understand how the Department will deal with that. In the Task Force report, we indicated that at least some of these agreements simply have to be renegotiated because there is no possibility of some elements of them being carried out.

There are a number of different compliance agreements in a number of States. Many of them include the agreed-on goal at the site in question, including Hanford and Rocky Flats, that the site will be totally cleaned up by the year 2019. This cannot be achieved. Believe me, those sites will be radioactive, in some measure, thousands of years from now. The Department in the short-term has to deal with the compliance requirements that exist now, and must move to renegotiate their unrealistic elements.

The last set of disconnects outlined in the Task Force report have to do with what is called goals, objectives, and needs, and this includes stakeholders' interest. The Department has not, in my opinion, yet really launched a comprehensive technical review to characterize across the Department of Energy complex's cleanup activities, a consolidated look at what the risks are and what technologies can be brought to bear to improve cleanup speed and lower costs, the need to identify and adopt cutting-edge technologies in future years, and what approach should be adopted for each of the risks and challenges that is identified.

This has been done partially. It has been done in some good measure at Rocky Flats, but not comprehensively across the range of EM programs. Thus, there are still compliance-driven activities that will force removal of material, which it is not possible to remove, or which is so costly or so time-consuming to remove that is not in any sense a practical objective. Stakeholders' interests are being accommodated increasingly, I think, but there is still a good ways to go.

For reasons that were outside the Task Force's EM study responsibility, the National Security Subpannel held several public hearings at a number of sites that it visited, at Los Alamos, at Sandia National Laboratory, and at Idaho National Engineering Laboratory. We had an opportunity to sample the feelings and opinions of the local citizens in each of those places. There has been environmental damage at each site. In many cases, although not in all, these involve radioactive materials. There is still clearly a big well of bitterness to which some of the Department's outreach will, hopefully, bring increasing harmony, but there are still very serious problems in that area. With that brief summary, I will conclude my statement.

Senator KEMPTHORNE. Dr. Kendall, thank you very much.

[The prepared statement of Dr. Kendall follows:]

PREPARED STATEMENT BY PROF. HENRY W. KENDALL, MASSACHUSETTS INSTITUTE OF TECHNOLOGY, ON THE DOE'S ENVIRONMENTAL WASTE PROGRAM

On February 1, 1995 the report entitled *Alternative Futures for the Department of Energy National Laboratories* was released in Washington. Prepared by a Task Force under the Chairmanship of Mr. Robert Galvin, it represented the work of some 23 Task Force members and a number of Department of Energy staff. Chapter IV, *The Environmental Cleanup Role* dealt with technical and managerial issues in the Department's largest program; one devoted to remediation, cleanup and risk reduction of the extensive radioactive and toxic waste contamination that is the legacy of the United States' World War II and Cold War nuclear weapons production. The world's largest environmental and waste management program (referred to here as EM), with a budget of nearly $6.5 billion annually.

The assessment set out in Chapter IV concluded that the progress toward cleanup goals was slower, and the costs incurred greater, than what could reasonably be expected and that the level of technology widely relied on was far lower than what the state of the art might be able to provide. Elsewhere in the Task Force Report, there was extensive review of weaknesses in DOE's management of a great many of its activities (summarized in Appendix A), coupled with a sweeping set of recommendations for improvements (comprising Appendix B). These difficulties have their greatest impact in the EM program simply because this is the Department's largest activity.

In March the Department released its study of the Task Force Report, *Response to Final Report of the Task Force on Alternative Futures for the Department of Energy National Laboratories.* The bulk of this present testimony consists of comments on the more important of the Department's eight responses to the material in Chapter IV.

[I]mprovements in DOE management and leadership are needed [1].

DOE's response: "COMPLETED. The Task Force seems to be unaware of the substantial progress the Department has already made in improving the management capabilities in the [EM] program at all levels. . . . The Department has hired more than 1,200 new employees . . . to provide needed management capability."

It does appear that the Department is taking some of the Task Force comments seriously and, in recent months, has started to move in the direction of decreasing both costly micromanagement and hobbling over-regulation. There is still a great way to go, however, for one persistent difficulty flagged by the Task Force was that there were already too many managers.

[T]he EM program [requires] a substantial commitment and high priority addressing the challenges of this program.

DOE's response: "COMPLETED. It is unclear why the Task Force suggests that the Department has not made a "substantial commitment" or made [EM] a "high priority."

The commitment identified in the recommendation was to effect a major improvement in the quality of the science introduced into the EM program, to reduce the inefficiencies and great expense that arise from management difficulties, to employ the great practical and intellectual resources of the National Laboratories in far more effective ways so as to speed the cleanup and reduce costs. No one disputes that an activity as large as the EM program receives great attention within DOE.

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[1] Recommendations of the Task Force are in italics.

[Establish] an 'Environmental Advisory Board (EAB),' reporting to the Under Secretary.

DOE's response: "COMPLETED. The Task Force failed to note the several existing advisory boards serving the [EM] program. We disagree that more boards are needed, rather than making better use of our existing boards: (1) an existing Environmental Management Advisory Board (EMAB), [etc.] . . . It appears that the Task Force was unaware of these existing advisory boards . . ."

The board we recommended was to have a special and powerful characteristic so as to "have influence and visibility in order to fulfill its role as an instrument of the Under Secretary. The High Energy Physics Advisory Panel (HEPAP) and the Nuclear Science Advisory Committee (NSAC) have such visibility, enhanced by their ability to give testimony to the Congress and their access to the Office of Science and Technology Policy. They are both widely believed to be quite successful." None of the present DOE boards have this special access, both quite important, in our view, to the successful working of the recommendation.

The national laboratories [should play a larger role] than at present in . . . the [EM] program.

DOE response: "PARTIALLY COMPLETED AND PARTIALLY REJECTED. The Task Force failed to recognize the significant role played by the laboratories in the [EM] technology development program, . . . Whether the laboratories will continue to play this significant role, much less a larger role, will depend on whether they can become cost-effective and produce useful results."

The Department is quite correct in its vigilance on costs but it should recognize that the laboratories have important contributions to make that in many cases cannot be duplicated by any other research and development organizations. This is so especially true in regard to the identification and introduction of advanced new technologies, often requiring large-scale field demonstrations, currently a sore need. The laboratories have unique resources and facilities and are accustomed to the complex, interdisciplinary blend of sciences and technologies that are the mark of large, technically-driven enterprises. Moreover the cost of employing the laboratories is considerably greater than it need be as a consequence of the Department's own managerial practices, criticized throughout the Task Force Report. The Report shows that laboratory costs can be inflated as much as 20–30 percent in consequence, with no associated improvement in program effectiveness. Ending redundant or unnecessary practices could bring costs down significantly and improve the efficiency of laboratory activities as well.

A concluding remark: As Chapter IV's brief history of events that forced the cleanup activities clearly shows, the problems that now challenge the EM program originated and worsened over roughly four decades. The overwhelming bulk of them were inherited, largely intact, by the present administration. However the present administration now "owns" the array of difficulties and the challenge is to proceed, as the Task Force Report states, to "marshal the skills high in the DOE to bring about the managerial changes that are required; raise the quality of science and engineering in the [EM] program, among other things by utilizing adequately the great power available on the national laboratories as well as the power among DOE contractors and in the universities. The changes only need to be set in place and exploited."

LANDERS & PARSONS,
ATTORNEYS AT LAW,
April 20, 1995.

PROF. HENRY KENDALL,
Professor of Physics,
Massachusetts Institute of Technology,
Cambridge, MA.

DEAR HENRY: I appreciate your letting me know that you will he talking to the Senate Armed Services Committee next week regarding the Galvin Committee Report, and specifically, the chapter on decontamination and cleanup of the DOE managed sites. I enjoyed working with you on the committee, and we all appreciated the work that you put in on this particular issue.

There are two points that I would hope you would find time to make in your presentation.

First of all; the report was really a team effort. We had briefings at virtually all of our meetings on the efforts of our subcommittees; and kept track of their efforts. Of course we were not physically able to participate in every site visit, so naturally we had to depend on one another for the impressions each member got. Nevertheless, I think it is incorrect and unfair that you are being singled out for criticism with regard to this portion of the report.

Having said that, I believe everyone involved in the controversy following release of the report should step back from their individual roles, and recognize that the report merely points out what has been well recognized for many years: that the cleanup efforts, very well-intentioned as they are, are plagued by their technical complexity, jurisdictional disputes over decisionmaking, unrealistic cleanup goals, and antiquated environmental laws. The current administration of the department is well-aware of these problems, and is bravely tackling many of them. I am sure they would be the first to admit, however, that everything is not "Ok", after all, many of these issues are beyond the reach of any agency to fix, even though there may be some general societal agreement that things must change.

It seems to me that the Galvin report, stripped of many of its more specific recommendations, merely encourages the Department to pursue many of the goals that Americans are looking for now: a common sense approach to solving problems, one that is efficient, technically sound and locally or community based to the degree that this is possible. I hope that you will, in representing all of us, be given an opportunity to focus on the ways our committee would hope this can be achieved.

All the best,

Sincerely,

VICTORIA J. TSCHINKEL.

SEMATECH,
Austin, TX, April 20, 1995.

HENRY KENDALL,
Professor of Physics and Union of Concerned Scientists,
Massachusetts Institute of Technology,
Cambridge, MA.

DEAR HENRY: I'm writing you this letter as the Chairman of the National Security Subgroup of the Secretary of Energy's Task Force on Alternative Futures for the Department of Energy National Laboratories; this activity was commonly called "the Galvin Task Force". The National Security Subgroup had the responsibility for looking principally at the three weapons laboratories—Lawrence Livermore National Laboratory, Los Alamos National Laboratory, and Sandia National Laboratories. However, as part of our recommendations regarding national security, we were exposed to a wide variety of environmental restoration and waste management issues, particularly relating to materials associated with weapons design and production since the 1940s. You were good enough to collect this information, and add to it information that you had gathered from other DOE sites. The information you collected was read carefully by several members of our Subgroup, especially myself, and by consensus appeared as a chapter (chapter IV) in the final report.

Chapter IV of the report makes clear that while there has been some progress in understanding the nature of radioactive waste management, our Nation still faces major problems. Some of the salient points are:

1. A large amount of the funds allocated for environmental restoration and waste management go into administrative overhead and legal costs.
2. There is a growing urgency to address problems because of potential spills and leakage, especially into nearby aquifers and rivers.
3. The entire clean-up will be a major cost, and will require a coordinated activity throughout the entire Department of Energy and other agencies such as EPA, OSHA, and the Department of Defense.

I believe Chapter IV is well written and succinctly states many of the issues facing our country. While it is focused on the Department of Energy, it is clearly relevant to other radioactive waste management areas as well.

Sincerely yours,

WILLIAM J. SPENCER,
President and Chief Executive Officer.

Senator KEMPTHORNE. Let me turn to Senator Exon and Senator Glenn and see if they have any opening comments before we begin a round of questions. Senator Exon.

Senator EXON. I will yield to my colleague who was here before me and take my regular turn, Mr. Chairman, if that is all right.

Senator KEMPTHORNE. Thank you, Senator. Senator Glenn.

Senator GLENN. Thank you. I would like to put my statement in the record, Mr. Chairman, and thank you very much. Our involvement with the Department of Energy cleanup started back in 1985 with Fernald, in Ohio, when we first had some complaints from some of the citizens groups. We went out thinking the situation was not as bad as they said it was, but after hearings and investigations we found out that it was much worse than they said it was.

Now, I think we probably have a stack probably 3 feet high of General Accounting Office studies we have done now over the nuclear complex all over the country. The biggest problem as I see it, and I will get into this a little more in detail later, is in this area of budgeting. I think you are right. Look into the mirror when you want to see what the problem is around here.

Back in the early days of this thing, I think the first estimate that was made was that it would cost somewhere between $8 and $12 billion to clean up the whole nuclear weapons complex all over the country. I remember those days with great fondness, because we have now gone up to where iron fences is $170 billion or so and green fields is $350 billion. We are not even sure that is the top; it may be going up.

My problem, I guess, is that instead of putting in the $9 billion to $10 billion a year on a steady basis year after year, so we can plan the cleanup and get the biggest bang for the buck, we turn the budget on and off. We go down, we go up, we waste two-thirds of the money—well, I do not know what percent but an awful lot of our money—by just turning programs on and off. In planning things, you cannot do that to clean up a thing like this, that takes multiple years to do. We have to have consistent funding. I do not know how we do that, but we have to figure out a way.

I think your point, Mr. Galvin, of "look in the mirror around here," is well taken.

[The prepared statement of Senator Glenn follows:]

PREPARED STATEMENT BY SENATOR JOHN GLENN

I would like to welcome our witnesses this afternoon, and I'll keep my statement very short so that we may proceed to their statements.

I am concerned, that in our efforts to reduce the budget, we may lose sight of some fundamental obligations—namely, our commitment to clean up and make safe the sites in the former production complex. We must not neglect this obligation, nor the workers and communities who supported it during the last 40 years.

When this cleanup effort got underway in 1989, no one expected it to be easy or cheap. Now, just as we are starting to get our hands around some of these problems, we hear about the naysayers who walk away from the cleanup, exempt these sites from environmental laws, or cut funding drastically. This is precisely the wrong approach, and something I will fight strongly.

Just last week I and several of my colleagues, including Senators Thurmond and Kempthorne, sent a letter to Senator Domenici which makes the point that progress is being made in this area, and that we must not back away from our commitments.

I would also like to make a special welcome for John Conway, head of the Defense Nuclear Facilities Safety Board. The Board was developed in part as a result of legislation I introduced in 1987, and I am eager to hear of his independent assessment of the safety hazards which face Department of Energy workers and the public.

Senator KEMPTHORNE. All right. Gentlemen, we will begin some questions to you. On page 30 of the Galvin Report, I would like to just read to you——

Senator EXON. Mr. Chairman.

Senator KEMPTHORNE. Yes?

Senator EXON. May I just read my brief statement?

Senator KEMPTHORNE. Certainly.

Senator EXON. Gentlemen, thank you very much for being here. I think this is a very important hearing. As you know, I have been very much involved in this over the years. I want to join, Mr. Chairman, in welcoming this very distinguished panel that is with us today. It is clear that the Department of Energy's Environmental Restoration program is under attack from many quarters. Some feel too much of the money is being wasted, some feel that too much is going to relatively low-priority cleanup sites, some feel that the standards for degree of cleanup are too stringent.

At the same time, many in Congress seem to be viewing the Environmental Restoration program as a source of "found money" that can be diverted to fund any other program under the sun. Yet, we are also told that the Department of Energy has entered into a number of legally binding consent decrees that have established enforceable timetables for cleanup actions, timetables that the Department now recognizes cannot be met at any funding level.

Mr. Chairman, I would note that most of these agreements were entered into under a previous administration, and that the current Department of Energy leadership has merely inherited these problems. However, the problems are there, and we have to try to find a strategy to guide our authorization of scarce Federal funds. Mr. Chairman, I certainly welcome these witnesses today, and I am looking forward to their testimony. I hope that their testimony and their answers to our questions will greatly enlighten us all.

Thank you, Mr. Chairman, very much. I will look forward to my round of questions.

Senator KEMPTHORNE. Senator Exon, thank you. I would note, too, in my opening statement that I noticed that these are not problems created by this particular team. They have been years in the making and the previous administrations also have been kicking the ball down the road.

Getting back to my question, page 30 of the Galvin Report, it says:

"Probably the most important reason behind the slow pace of assessment and cleanup is the low quality of science and technology that is being applied in the field. Many of the methods such as pump and treat for contaminated groundwater remediation cannot provide the claimed benefits. There is a lack of realization that many, and some experts believe, most existing remediation approaches are doomed to technical failure. Others would require unacceptable expenditures and much extended time to reach their stated objective."

It goes on to say, "Over time, an increasing proportion of Department of Energy resources has been going into Department of Energy management in an attempt to lower environmental costs. A Congressional Budget Office report concluded that, 'At least 40 percent of the cleanup program's funds are devoted to administrative and support activities, a level that many reviewers have considered excessive. They represent a proportion that is significantly higher than the shares spent by some other government agencies that may be performing similar tasks.'

"DOE provides the most expensive environmental services of any government agency, with costs 40 percent above the average in the private sector."

Mr. Galvin, you have noted in your comments that you were speaking in laymen's terms, and I would ask that you continue that. I would like your assessment of this—and Department of Energy and Dr. Kendall as well—I would like for you to respond to this aspect that the Department of Energy that a great deal of money is not being used for the actual cleanup and how we can redirect that. What should we be doing to ensure that we finally get the actual cleanup?

Dr. KENDALL. Before I respond directly to your answer, let me start by characterizing the general problem, the problem that is facing this whole EM program. That is its enormous size and scale. It is staggering in terms of the amounts of materials that are around, the way they are dispersed, and with the enormous diversity, forms, shapes, and conditions of hundreds of different radioactive materials in all kinds of circumstances, underground in tanks and aquifers and various kinds of storage, some dubious containers and so forth. It is a very daunting problem.

There are a number of factors that I believe have given rise to the difficulties: inefficiency of work done and money not usefully and effectively spent. One for example, noted in the Task Force report, is that the huge flow of money has acted, in many cases, as an anesthetic. It can look like a welfare program. The recipient communities tend to resist changes that would alter the flow of money in any way, including changes to improve efficiency, which can mean decreased money and fewer jobs. That is one component of the problem.

Another is the matter I touched on in my opening statement, part of the criticisms in the Task Force report, the low-quality of science, which you quoted. That is a great inhibitor of rapid and effective cleanup, or remediation. Unfortunately, it prolongs the task and prolongs and raises the flow of funds.

Pump and treat is one of the recognized examples in this area. Pump and treat deals primarily with underground contamination, a main problem. It has resulted from radioactive liquids that were run out onto the ground in intentional leaching ponds and allowed to sink into the ground. Toxic chemicals were also disposed of into the ground.

Now, the problem is to recover the materials sometimes deep underground, sometimes also in aquifers. In pump and treat, you drill a well, you push some fluid in that you hope will dissolve a portion of the toxic material and then you pump the fluid out again and try to remediate that way. It does not work very well. In many cases it really does not work at all, and yet there are extensive reliance on the procedure at many contaminated sites, particularly Hanford.

Remediation of underground contamination could be improved, at least in principle. There are many technical opportunities known to the laboratories for the development of replacement technologies, which would be more effective. In some cases, compliance agreements clearly force expenditures which are ineffective and should be halted.

I have no recommendation for how the legal aspects of this should be dealt with. That is not my field, but I recognize that it is a major problem. In some cases I think it is practically necessary, and it is justified on financial grounds—although, this would have to be studied in specific cases one by one—simply to leave some of the material where it is in the environment simply because it appears unrecoverable at achievable costs and on achievable time schedules.

In this regard let me expand a bit on the remark I made in the introductory segment, that I do not think the Department has the kind of synoptic technical view, following a high-level technical assessment across the Department of Energy complex of EM activities, of what should and should not be pursued in the cleanup, and what new technologies could improve the prospects.

Such a study is what the Task Force report recommended, for it would provide much more detailed information which is not now available on which of the contamination should be abandoned, which cleanup activities should be pursued with current technology, which ones should be delayed, awaiting technologies which are in the wings but need developmental and research advances before being applied to the field.

If I were running the program—and I am not—one of the first things I would do would be to organize such a technical assessment across the complex. It would answer a lot of the questions which will continue to hang until that is done.

Senator KEMPTHORNE. All right. Thank you very much.

My time is up, but Secretary Grumbly, you have indicated you would like to respond to that?

Mr. GRUMBLY. If that would be all right?

Senator KEMPTHORNE. Certainly.

Mr. GRUMBLY. First, I agree with a lot of what Dr. Kendall said. I think on the program cost front, administrative cost front, having come from the chemical hazardous waste industry, I would say that in the early years of any of the remediation programs, the amount of program cost tends to be higher than it ought to be, because we are doing a lot of characterization. In the Department of Energy complex, what you are also left with is a situation of what I would call "Cold War" funding mentality in which dollars were essentially thrown against problems without really the kind of incentives for either Federal employees or contractors to do the job in the most cost effective way possible.

I think one of the things you have to do from an economics' perspective right away is change the nature of our contracts, so that you really emphasize the necessity of getting what you are paying for. That can in and of itself drive down the program costs. I think that Dr. Kendall is right about the necessity for what he calls a "synoptic" approach. My own views of how you get that, having worked in the system, is that so many of our sites are so big and they have such different kinds of geographical types of problems. I mean, the Savannah River Site is dramatically different from the Idaho site in terms of where the groundwater is, in terms of its geology, that we should at least try first before we get into some gigantic analytical process that will cost lots and lots of money is to do it on a site-by-site basis.

What we have done, we have begun the process at Idaho, where we have just completed, with the help of the new contractor there, Lockheed, the kind of analysis, the kind of systems analysis, that will in fact enable us to know what technologies we ought to be applying. We need to do that around the rest of the complex, and we are.

Speaking of pump and treat, it is a very interesting problem. I will be very brief. The problem with pumping and treating is not the technology itself; it is the standard to which we are being demanded to clean up. I mean, pump and treat is fine if you want to get it to levels that pump and treat can get you at. But the pumping and treating technology cannot get you to the regulatory standards for drinking water that have historically been applied in this area. If we want to do that, we are going to have to get much cheaper, much more cost-effective technology than we currently have. So, the issue about technology is not simply having the technologies, it is technology to the particular regulatory standard that you have to have.

That brings up an area where I think the national labs and us really can make a major impact; and that is, understanding much better than we do now the scientific basis for a whole lot of the environmental regulation that is out there. We are living with a fundamental science base, an environmental science base that was essentially put together 20 years ago. The laboratories have tremendous capability to try to help us update that. We need to make the linkages between the national laboratory system and the environmental science system that underpins the regulatory agencies. I mean, we do not set the standards by which we decide to clean up. We are price-takers in that equation. But it seems to me what we need to do and what the labs can do is to really muster the kind of effort that is necessary to work on the standard side, as well as the technology side.

Senator KEMPTHORNE. Mr. Secretary, thank you very much. Senator Bingaman.

Senator BINGAMAN. Thank you very much, Mr. Chairman.

Let me ask Secretary Grumbly a question here. It seems like everybody is in agreement that we need to do a better job with the technology development for accomplishing this cleanup. I believe Mr. Galvin's report makes that case. In fact, I believe in your prepared statement, you summarize the budget request for technology development. It is pretty clear that you are proposing a decrease from 1995, fiscal year 1995, in fiscal year 1996 in these areas. It strikes me that if there is general agreement that effort needs to be put into technology, that 1996 would be a good year to start doing it. I am wondering why that is not the position of the Energy Department.

Mr. GRUMBLY. Right. Well, first of all, I think essentially it is a constant request in technology, because there have been some transfers in the program, but I take your point. We need to do two things. First, we do need to work ourselves out of the unreasonable parts of the compliance agreement problem that has been described here, so that we can devote, on the margin, more resources to the science and technology parts of this program.

I underline both "science" and "technology." As long as we are constrained to having, essentially, close to 90 percent of our budget wrapped up in either direct nuclear safety issues or meeting these compliance agreements, essentially technology development ends up being the "poor sister" of the equation. I think as far as future budget development is concerned, and I am on record as saying this, then I think we need to do two things: at least to hold the technology at the current level, and hopefully increase it, but also improve the basic science component that is available.

Senator BINGAMAN. These compliance agreements that you are talking about, I believe Secretary O'Leary testified before the committee a couple of weeks ago, and indicated that these are agreements that do not have the traditional clause in them, which I thought was in all government contracts, which says that the obligation of the government is subject to money being appropriated by the Congress. Somehow or other that was not included in these agreements?

Mr. GRUMBLY. Well, our suggestion all the time is that that be included in our agreements; and in four of our current agreements, they are: Fernald, Ohio; Weldon Springs; Brookhaven; and Livermore. The national labs have done a little better job than some other places. But, with respect to our big agreements, many of the States have rejected that approach and essentially said that the traditional lack of money for their site is not going to cut any ice with them. Our general counsel tells us, I am going to put this on our lawyers at this point, says that the breadth of our exposure goes to the entire EM appropriation, not just to the money that is given to a particular State or a particular site.

The way Congress appropriates the money historically is by line item environmental restoration program, waste management program, and facilities transition. It does not appropriate the money by site. Our fire wall only begins at the end of the EM program, not at the end of any particular State's problem. The States have fought us very hard on this.

Senator BINGAMAN. I would suggest to our chairman that this is a reverse unfunded mandate that the States are imposing on the Federal Government.

Mr. GRUMBLY. It is.

Senator BINGAMAN. Have you considered coming to Congress with a request for us to write legislation overriding the effect of these agreements?

Mr. GRUMBLY. Yes, we have suggested it. What we think is a better course is to engage in an active period of voluntary renegotiation with the States in which we mutually educate ourselves about the new fiscal realities that exist in the land, and try to voluntarily, using risk information and other information that we have, change the nature of these agreements.

It seemed to us that it would not be appropriate as a partner to the States in this area to simply come up here right away and ask you all to write legislation without having made the "old college try," so to speak, to voluntarily renegotiate. We will have to, because the Secretary and I are committed to remaining within the confines of the law.

Senator BINGAMAN. Well, I certainly agree that you ought to make the "old college try," but I think it is difficult to argue for very many years that you do not put the resources where you think they should go, because of unreasonable obligations you have taken on with the States, and not come to Congress and ask for relief from those obligations.

Mr. GRUMBLY. I think you are right. I want to emphasize the positive again in this equation; and that is, that by both anecdote and analysis I believe that somewhere between 80 and 85 percent of what we are signed up to makes sense. But, when you are talking about a program that is of this magnitude, 15 or 20 percent is, as Senator Dirksen used to say, "real money."

Senator BINGAMAN. My time has expired, Mr. Chairman.

Senator KEMPTHORNE. Senator Bingaman, thank you very much. Let me note that we have the Chairman of the full Senate Armed Services today with us, Chairman Thurmond.

Mr. Chairman, we have asked any Senator to make any opening comment, and then it would be your turn for a round of questions; if you have any opening comment that you would like to make?

Chairman THURMOND. Very briefly.

Senator KEMPTHORNE. Mr. Chairman, thank you.

Chairman THURMOND. Mr. Grumbly, I am tied up with another matter concerning this committee. You are responsible for administering a program using atomic energy's defense resources for what has been called the largest civil works program in history, the cleanup of the Department of Energy nuclear weapons production sites. This committee is responsible not only for overseeing this activity, but also for overseeing the Department's nuclear weapons activities funded from the same atomic energy defense account.

As you know, the President's policy has reaffirmed the essential nature of nuclear deterrence in the Department of Energy's nuclear stockpile maintenance and stewardship activities for the national security. I have to say, Mr. Grumbly, that the report of the Department of Energy's Environmental Management program during this time is somewhat disconcerting. I want to ask you this, do you feel that you can fulfill your mission? Is that a reasonable time?

Mr. GRUMBLY. I think it is going to take three generations, Senator, to fulfill the mandate of this program.

Chairman THURMOND. What is the cost of that?

Mr. GRUMBLY. I think if we do it smartly and with all the help from science and technology that we can get, maybe it could be done for $200 billion.

Chairman THURMOND. How much?

Mr. GRUMBLY. $200 billion.

Chairman THURMOND. $200 billion?

Mr. GRUMBLY. Oh, yes, sir, over 75 years.

Chairman THURMOND. Now, does that cover all the places in the United States?

Mr. GRUMBLY. Yes, sir, it does.

Chairman THURMOND. The Department of Energy has just issued its Spent Nuclear Fuel Environmental Impact Statement. Of all of the alternative cited plants the Department of Energy favors sending all of the spent fuel in question, I believe, to Idaho——

Mr. GRUMBLY. Not all, Senator, some comes to your——

Chairman THURMOND [continuing]. And the Savannah River Site in South Carolina.

Mr. GRUMBLY. Yes, sir.

Chairman THURMOND. What is the Department of Energy's rationale for this cited alternative as contrasted with spreading the spent fuel among more than these two sites, and it is contrasted with a central, permanent repository? In other words, why does the Department of Energy think that the citizens of Idaho and South Carolina should bear the whole burden of the so-called "interim storage"?

Mr. GRUMBLY. To put it briefly, Senator, we think that keeping the spent fuel at a wide variety of places around the country would require substantial additional resources to build facilities, which we already have at both South Carolina, Idaho, and the State of Washington, I might add. Washington is really the largest repository. We do not think that would be a wise use of the public's resources.

Second, we believe that we should organize our fuel in a way so that it can all go directly to a final geological repository after some processing or other form of treatment in South Carolina, and most of the fuel in Idaho can go directly to a geological repository.

Chairman THURMOND. This spent nuclear fuel can produce plutonium, can it not?

Mr. GRUMBLY. Yes, sir, if processed.

Chairman THURMOND. Why could that not be used to produce tritium?

Mr. GRUMBLY. Well, I think, Senator, that we clearly will have to make a choice to produce tritium. We do not have the amounts that we need for the outyears, and it is clear that South Carolina is going to be among the major choices and options to be considered in that.

Chairman THURMOND. There are many people who feel that we should produce electricity, and then we could produce tritium. I understand the power companies, for instance, down in my area said that they would build the facilities for electricity. Had you thought about the advisability of that?

Mr. GRUMBLY. Senator, I think putting, if I understand the question, a reactor in South Carolina to produce tritium is one of the two major options that the Secretary of Energy is considering right now, and then she will make a decision on it by the end of the summer.

Chairman THURMOND. How would you feel about that?

Mr. GRUMBLY. It would solve a lot of my problems, Senator. [Laughter.]

But, it is not my decision to make.

Chairman THURMOND. Mr. Grumbly, the March 1995 budget report to the Senate Energy and Natural Resources Committee made six recommendations to Congress, based on its evaluation of the Hanford site cleanup. It says that Congress shall reform the legal and regulatory framework for the cleanup, among other things. Would you comment on the recommendation, and tell this committee if the Department of Energy will propose a regulatory reform package on your program to Congress?

Mr. GRUMBLY. Senator, we have testified that we are in favor of a reasonable risk assessment bill that does not have the supermandate overrides. That would help us a lot. We believe that there ought to be new Superfund legislation that enables us to take into account future land use. We believe that Congress ought to appropriate our money by sites, so that we do not have the problem with compliance agreements. That was discussed earlier, just before you came in. Also, we believe that we need to work diligently with the States to get them to change the compliance agreements where they do not make rational sense, i.e., where the benefits do not outweigh the costs.

Chairman THURMOND. I have one more question. Dr. Kendall, on page 37 of the Galvin Report, you state that, "an increment of $400 million annually on laboratories but the ramped up over time to twice that sum is, roughly, the scale needed to pursue R&D and improve programs."

Would you please elaborate on the kinds of activities which the laboratories might undertake with this ramp up, and do you have any subcommittee materials which you could provide to us that detail this proposal and its rationale? [No response.]

Senator KEMPTHORNE. Dr. Kendall, I believe that was directed to you.

Dr. KENDALL. Oh, I am sorry.

Chairman THURMOND. Yes. Dr. Kendall, that question was for you.

Dr. KENDALL. There are a number of technologies in the wing that have not been fully developed and that have not gotten to the stage of field deployment, which it appears would speed up cleanup activities a great deal if they were pursued vigorously. They include many diagnostic technologies for finding out what the problems are, for example, in the Hanford waste tanks whose inside constituent distributions are not well known.

There is quite a long list of such potentially useful technologies. It constitutes a shopping list type for the principal weapons laboratories, and I believe a shopping list elsewhere, but particularly at Livermore, Los Alamos, and Sandia. Many things that are potentially very helpful are not being exploited. It is for those, the $400 million distributed among either two or three of the laboratories, but in particular Livermore, Los Alamos, and Sandia.

At the rate of $100 billion or $200 billion annually per laboratory, one can push advanced technology and also to carry out something that I mentioned in my introductory statement at the beginning of this hearing, which is to conduct a synoptic review of what the risks, hazards, and potential technologies are across the Department of Energy complex. These could speed the cleanup. Such a technical study has not been accomplished in my opinion and in the opinion of others, but this is where the money should go.

Chairman THURMOND. Doctor, does it make sense—I will ask one more question—when we take this spent fuel back from these countries abroad? I believe that is what is being done now, is it not, is to bring this fuel back to this country?

Dr. KENDALL. I think I am not in a position to answer that, Senator.

Chairman THURMOND. Are we bringing this fuel back?

Dr. KENDALL. Pardon me?

Chairman THURMOND. Why cannot we use it to make plutonium, which in the end could be used to produce tritium?

Dr. KENDALL. Well, we could certainly use spent fuel for making plutonium, more precisely extracting its plutonium, but the situation is that we do not need plutonium at the present time. We have a great deal of plutonium, indeed an excess. The troubling problem is that there is too much rather than too little. In fact, last year there was an important National Academy of Sciences study on how to deal with the excess plutonium.

The recommendation of those experts was that it be left in the spent fuel and not separated. It can be put into temporary, and later, hopefully geological storage simply because it turns out not to be economical to use this material in nuclear reactors. Among the other concerns is that plutonium presents a national security problem. That is the best scientific judgment on that matter at the present time, that National Academy of Sciences study.

Chairman THURMOND. I suggest you look into this more carefully, Doctor. Thank you very much.

[The prepared statement of Senator Thurmond follows:]

PREPARED STATEMENT BY SENATOR STROM THURMOND

Mr. Grumbly, I want to thank you for your presence this afternoon. However, I must tell you that I am disappointed that the Department did not comply with the committee's policy to provide written statements at least 48 hours in advance of the hearing. In fact, we received your statement less than an hour before the hearing. I hope that in the future the Department will be more timely.

Mr. Grumbly, you are responsible for administering a program using Atomic Energy Defense resources for what has been called the largest civil works program in history, the clean-up of the Department of Energy nuclear weapons production sites. This committee is responsible not only for overseeing this activity, but also for overseeing the Department's nuclear weapons activities funded from the same Atomic Energy Defense account.

As you know the President's policy has reaffirmed the essential nature of nuclear deterrence and DOE's nuclear stockpile maintenance and stewardship activities to National Security. Therefore this committee must balance the needs of both missions.

I have to say Mr. Grumbly that report after report on the Department of Energy Environmental Management Program, whether during this administration or before, has been almost wholly negative. General Accounting Office reports, the Blush/Heitman report, the Galvin report all cite fundamental problems in the strategy and implementation of this program. Our purpose today is not to heap blame on you, but to find a better way to administer this important mission. That is why we have asked Mr. Galvin and Dr. Kendall to appear with you. I hope that you will deal with these issues not in a defensive way but in a way that will enable us to find a better strategy, even if that requires major legal and regulatory reform.

Finally, I hope you will address why the Department believes that the citizens of South Carolina should have to accept foreign spent nuclear research reactor fuel on an interim basis when the Department has not made any progress on finding a permanent storage site for nuclear waste.

Thank you Mr. Chairman.

Senator KEMPTHORNE. Thank you, Mr. Chairman. I hope that you fully appreciate that when you state your 75-year timeline that at that time Senator Thurmond will be asking the Department of Energy if you met the goal. [Laughter]

Mr. GRUMBLY. The thought was going through my mind.

Senator KEMPTHORNE. Senator Glenn.

Senator GLENN. I want to see as much money go into R&D as we can, but I have been a little dubious about where it goes. We have been talking about getting a magic-bullet R&D fix ever since we started out with this whole thing about 10 years ago, in 1985. Mr. Grumbly, you have about what? About $400 million going into this now?

Mr. GRUMBLY. That is right, Senator.

Senator GLENN. Do you have any areas here where you see something that would be, in effect, a very major breakthrough if we put a little more money into it? I am not against chasing the R&D will-o'-the-wisp if we think we have some possibility of getting there. Every year we are on some new technical R&D thing, and we think it is just about to get us over the hump, and nothing ever seems to happen—at least in the past 10 years.

Mr. GRUMBLY. Well, I think that over the last couple of years, we have really tried to focus our technology efforts in four or five areas: first, is on dealing with these tank wastes that we have out at Hanford; another is dealing with the plutonium problems that we have at places like Rocky Flats; the other, the third, is dealing with the kind of groundwater problems that Dr. Kendall talked about; the fourth is in the WIPP mixed waste area; and the fifth is in how we would decontaminate and deal with contaminated metals. Each one of those areas represents a technology focus area for a national laboratory. For example, we have made the Idaho National Laboratory the lead lab for mixed waste, we have made Los Alamos the lead lab for plutonium, and we have made Pacific Northwest Labs the lead lab for the tank waste problem.

In each one of those areas, there are some major possibilities for making change. Also, I think, and I would particularly say in the area of how to deal with spent fuel and all of this nuclear material that we have, that we have to step up to the plate and make a more significant investment than we have made in the past.

Senator GLENN. Most of the new R&D things I think we have seen over some years, though, have been dealing with specific instances like the tanks and Hanford.

Mr. GRUMBLY. That's right.

Senator GLENN. We have spent a bundle.

Mr. GRUMBLY. Well, let me just say this.

Senator GLENN. We have to deal with it. Even if we solve the tanks at Hanford, we still require a lot of research that is going to help us in other places around the whole complex.

Mr. GRUMBLY. Well, I think that, for example, we have to find a way to drive down the $40 billion estimated cost for dealing with the tanks at Hanford, which is something that the country is willing to afford. I think it is worth a reasonable R&D investment to do some things there. Also, Senator, if you believe, as I do, that it was a chimera to think that this was a 25- or 30-year program; then if it is going to be a longer program, we have the time to make some investment in some of the fundamental research areas that we really do need help on.

Senator GLENN. Let me ask a question on privatizing, because that has bothered me a little bit too. I would like to ask Mr. Galvin and Dr. Kendall about their views on this. Do they have views on this, as to whether we could make some steps forward by privatizing? In my view, I am not quite sure that is the way to go for this reason.

There are limited numbers of people out there you can contract with to do a big job like this. Most of those people have been involved in getting us into the problem, to begin with. Yet, we are going to ask them to go out there and we are going to sign a contract with them?

Now, they are going to undo what they did not responsibly do when they were in charge of some of these places? I have never been quite convinced that we maybe should just privatize all of this. Do you have any comments on that?

Mr. GALVIN. The term that, Senator, we use is corporatize and I do not wish to dance on the head of a pin, but we do wish you to understand that there is a difference between privatize, appropriatize, and it has to do with the function of corporatization and not the equity change in the ownership. Those are details that can be otherwise elucidated. We respectfully suggest, sir, that what would happen under corporatization is that the other side of the coin, the administrative side of the coin, if you, the Congress, would endow this new corporate function with the authority and limits on repairs, it would substantially change high cost of doing business in a very heavily populated department called the Department of Energy that spends an inordinate amount of time—at your direction—Congress, direction, to go out and check and inspect the quality, et cetera. A great deal of your funds are just going for that kind of chasing one's tail.

I also suggest, sir, that if you put in the hands of a group of trustees, which could be a call of any circular people sitting in this room, there is a responsibility. You will find that the trustability responsibility would be much better for us than it is when it is purposely done through the administrative class of activities that are obligated by our government system at this time.

If the system of running it would have a very big positive importance in the estimation. If you would endow this institution with the authority to get its job down. I would just go and just say something anecdotally. When we talked to people like Inspector Generals and auditors, et cetera, they reveal to us that they do not understand, if that knowledge in the Department they are working, and there is a consequence.

They have to devote for a timekeeper in something that produces a report that is of a numbers' nature, not a science nature; and a police nature versus a technology venture. Now, I think a part of the problem, sir, is that you have to cause the Department to change its modus operandi, not its skills, at Mr. Grumbly's level, and get focused back on the fact that this ship meets a technology institution and not just an administrative institution.

Senator GLENN. My time is up. Mr. Chairman, just a comment here. I take it one of the reasons we through the years have gotten into some of this micromanagement that you are critical of, and I am critical of too, one of the reasons you got into that was because we did find out things going on at some of the labs that were unconscionable. They were bad. There was horrible waste going on in some of these places.

We then wrote requirements into the law, and specified things to be looked into. We can bear a lot of the blame here, but a lot of it came out there because these places were not being managed properly, to begin with. We have a lot of that, and we have several reports put out to substantiate that.

I hope you are going to have a second round here, because I do have other questions.

Senator KEMPTHORNE. Yes, sir. Dr. Kendall, I have great sympathy with your remarks about the search for a "magic bullet," which diverts attention in many cases from real problems, that it costs extra and can be a waste of time. I do not think from my knowledge of the available technologies that there are any astonishing, unknown solutions, that is "magic bullets." A search for those is an illusion and a time waster. However, the Department has been criticized in numerous reports, including our task force report, for simply not doing an orderly job of searching out the straight forward, improved technologies that are potentially available and, although run of the mill, are just not being pursued and adopted.

Last, a comment on Bob Galvin's remarks. It should be clear that he is directing his comments to the Department of Energy and their national laboratories, and not to the contractor system, which will remain a necessary part of the cleanup activities.

Senator GLENN. Well, I was referring to the national labs when I said the waste we discovered out there, so we put some requirements in ourselves too. Maybe those have hurt things more, and maybe we should take some of those things off at this stage; I don't know.

Dr. KENDALL. Well, the laboratories' cleanup problems are somewhat pale in comparison to the Department of Energy complex sites.

Senator GLENN. That is true.

Senator KEMPTHORNE. All right. Senator Exon.

Senator EXON. Mr. Chairman, thank you very much. Let me address a question to you, first, Mr. Grumbly. The midrange of the Department's recent estimate for cleaning up the costs for the contractor was about $230 billion, I believe. By coincidence, the cleanup funding appropriated since 1989 through this year totals about $23 billion. Now, that just happens to be 10 percent of the midrange total. I want to ask you, given the fact that we have spent about 10 percent of the midrange total, how close to 10 percent of the cleanup job has been completed?

Mr. GRUMBLY. I do not think we have finished 10 percent of the job yet. I think we have about 500 completed cleanup actions out of a total of about 10,500 around the complex; so, I think that is about more like 5 percent. I think what we have done is, we have characterized in, a way that people have never done before, the kinds of problems that we have in the Department of Energy complex.

I think that discontinuity between 5 and 10 percent does represent some serious problems, in terms of the economics of this organization. I think we have to simply find ways to become much more productive, to stop being pogo, to get rid of some of the unnecessary Department of Energy orders that plague us, to deal with the economics of contractors in the system, to drive down our project management costs. I think it is legitimate to criticize us for not having been as productive as we needed to be in the past and that we need to be in the future.

Senator EXON. Would you say we have completed 2 percent or 5 percent?

Mr. GRUMBLY. I think we are in the 5 percent range.

Senator EXON. The 5 percent range. Could you give us any more statements today with regards to the $230 billion estimate we have been all over the lot on over the years? Do you think that $230 billion is the best educated guesstimate at this time?

Mr. GRUMBLY. Absolutely. Is it right, Senator? No, the number is not right, because anything that goes over 75 years is going to have a big error band on it. But I think that it is informed by more data than any study has been before. I think if you look at the assumptions that are built in, that it is in the ball park. Now, I hope that we can do dramatically better on the technology side, in line with the words of my colleagues here today. But I think even if we do dramatically better on the technology side, we are not going to be able to convert this from a $250 billion problem into a $50 billion problem. It is a significant expenditure of national resources out into the future.

Senator EXON. When the Secretary was here 10 days, or 2 weeks, ago approximately, somebody questioned—and I will not go into those, but your answer may not be significantly different from hers—but I shared a concern that has been expressed to you here today, with regard to the on-again-off-again proposition.

In my opening statement, you heard me say I am very much concerned about the fact that we do not seem to be on a glide path assured funding level. Without that I do not know how we could criticize the Department too much for not being further along than we are.

I must say it is very frustrating to me. I know what the situation basically is at Hanford, and I do not like it. It seems to me that if I do not like it, then I probably will go on not liking it for some period of time to come, because I am not sure that we are on as much of a course as I think we need to be on. I wish we had the money to work this faster; I suppose we do not.

As I said in my opening statement, it seems like people are looking around now and saying, "well, you know, here is a pot of gold. If we cannot spend it right away, let us put this over on something else." I am afraid that that is pretty bad planning from the standpoint of getting at the job that we have been talking about and appropriating money for, for a long time. It is not moving nearly as fast as I would like to see it.

Mr. Galvin and Dr. Kendall, the Galvin Report was critical of many aspects of the Department of Energy cleanup effort. You were critical of the evident lack of prioritization in addressing the cleanup problem. We in Congress also face limited resources with conflicting priorities. It would help us immensely, it seems to me, if you could suggest to us what the congressional priorities should be in addressing cleanup issues, since it appears that our simply authorizing and appropriating large sums of cleanup activities have not been sufficient, and in my view, has not done what we thought it would do.

Mr. GALVIN. Let me start, sir. I think that if Congress could apply its wisdom and its authorities to changing these compliance regulations to where those who know how to manage, or who we presume and trust are the best to determine for us what ought to be done and all of the particular situations are allowed to be done based on scientific principles. Second, that you would challenge the Department to change its mix of where it spends its money and that it would be strongly monitored to reduce its administrative costs by an order or something. I do not want to use a scientific term "order of magnitude," but my guess is it could be cut by from 50 to 75 percent, just to pick an easy number. Then, third, they are turned over to the Grumbly's of this institution. But you want them to really feature the most practical followup of technology roadmaps that have some potential new application to for 6 years from now. And then, finally, assured that these people will have a consistency of resources to where they get the job done. That is a generalist point of view. I hope Henry Kendall could flesh that out in more particulars.

Senator EXON. Dr. Kendall.

Dr. KENDALL. Well, I guess it is nice that Bob Galvin and I have worked together and so long on this, because his important priorities are, indeed, just mine. The Department of Energy has, I believe, to get its technical house in order. They should study in more detail and in a comprehensive way what the risks are and what should be done about them: which things should be abandoned; which things should be delayed, waiting for new technology; which things should be pushed; and then to get its priorities organized inside to achieve these goals, bringing in the national laboratories, employing advanced technologies in the field.

They will have to deal with the problems imposed on them by the compliance agreements. It is an enormous stumbling point. Secretary Grumbly has come back to it again and again in his written and oral testimony. We have noted it in the Galvin Task Force Report. Whatever help Congress can give with that is certainly going to be needed. I personally at the moment see no clear way out; although, it is not in my skills to be expected to see it, but it is of course very difficult.

Finally, the very serious problems of Department of Energy micromangement of its activities, which are one piece of the general side of management problems, criticisms of which go to most all of Galvin Panel Report. There Congress can also, I think, keep a keen eye on things, insist that they be corrected. If corrected, it would surely bring costs down, raise the efficiency of the cleanup effort, as well as raise the efficiency of a lot of other efforts inside the Department of Energy. That too is a very important matter.

Senator EXON. Gentlemen, my time is up. I did want to take a moment, if I might, in closing to say, Mr. Grumbly, thank you for what I think has been an outstanding job that you have done there.

To you of the Defense Nuclear Facilities Safety Board, I was here when you started, when we first selected you, I think you have just been outstanding in what you have done. Just keep plugging along and working away on this. It seems to me that the statement that you made about putting more money into cleaning up things rather than planning to clean them up is something that we should be about. Maybe the up-front costs for this kind of a mammoth program, may be somewhat justified.

As one Member of Congress that has been intimately involved in this for a long time, I would simply tell you that I hope, Mr. Grumbly, that you can get action digging contaminated dirt and doing something with it someplace, somewhere, somehow. That way in another 5 years from now we will not find ourselves sitting here by saying, "This is a big problem we have and we have got to be about. We have been about it for 12 or 15 years now, and we are making some progress but not quite enough." I am not faulting any of you, who I think have done an outstanding job. I thank you for your service to date, and hang in there.

Thank you very much.

Senator KEMPTHORNE. Yes. Senator Exon, thank you very much.

Mr. Grumbly, I would like to ask five questions here in this round, so if you could be brief. Secretary O'Leary says she wants to open an interim storage facility for spent nuclear fuels. Since the administration will not support the pending legislation to open such a facility, does the recently released EIS mean that Idaho and Savannah River are the administration's preferred interim storage sites?

Mr. GRUMBLY. Technically, no, they will be temporary storage sites with a commitment to get that stuff out and into a final geologic repository.

Senator KEMPTHORNE. I am not completely familiar with the President's position regarding the legislation to open an interim storage facility at Yucca Mountain. Can you clarify the President's position to me?

Mr. GRUMBLY. I would like to present the President's letter for the record. The President can speak for himself on this. As I understand it, what he said to Governor Miller of Nevada in a letter of April 4 is that he could not support legislation at this time. To me that means that we can still work on the problem.

[The information follows:]

The letter from the President to Governor Robert Miller of Nevada, dated April 4, 1995, regarding the administration's position on legislative proposals to create an interim storage facility at Yucca Mountain, Nevada, is attached.

THE WHITE HOUSE,
Washington, DC, April 4, 1995.

Hon. ROBERT J. MILLER,
Governor of Nevada,
Carson City, Nevada

DEAR GOVERNOR MILLER: It was good to talk to you recently on your concerns about the civilian nuclear waste program. As you know, I am committed to implementing this program in a way that is objective and fair to the citizens of Nevada and the rest of the Nation,

Recent news reports identify important issues that need to be resolved. With respect to proposals that would create an interim storage facility at Yucca Mountain, I want to make it clear that at this time my administration *cannot* support any legislation currently before the Congress.

I look forward to continuing our discussions on this. I know you understand the national interests involved here. I welcome your perspective on how to deal with these issues in a constructive and equitable manner.

Sincerely,

Bill Clinton.

Senator KEMPTHORNE. Are you willing to work on that problem?

Mr. GRUMBLY. Every day, Senator.

Senator KEMPTHORNE. Secretary Grumbly, as you know there are currently over 100 types of spent nuclear fuel stored at the Idaho National Interim Laboratory. Given this large variety of fuel types, what steps is the Department of Energy taking today to ensure that these materials will be qualified for disposition in a permanent repository?

Mr. GRUMBLY. As I understand it, Senator, and I will get you a rundown on fuel type by fuel type, is that the vast majority of fuel that is both currently at and is scheduled to be at the Idaho location, is ready to go into a geologic repository, the exception being the EBR2 fuel. That will require some additional processing. All of the Navy fuel, at least according to Admiral DeMars, who is in charge of the Naval Reactors program, is ready to go directly to a geologic repository, but I am happy to give you a rundown on a piece-by-piece basis.

[The information follows:]

The Idaho National Engineering Laboratory currently stores spent nuclear fuel from a variety of Department of Energy programs and other sources. This spent nuclear fuel inventory includes fuel from the Navy's nuclear propulsion program and a limited amount of special-case commercial fuel. The waste acceptance criteria for disposal of this fuel in a permanent repository have not been developed. The final criteria will in large part determine which types of fuel could be directly emplaced in a geologic repository. However, based on preliminary information and engineering judgment, there are currently 400 Metric Tons (total mass) of special-case commercial fuel (or approximately 97 metric tons of heavy metal) and 560 Metric Tons (total mass) of Navy fuel (or approximately 10 tons of heavy metal) (the total current inventory of Navy fuel at INEL), that the Department may be able to directly emplace in a permanent repository without treatment.

Senator KEMPTHORNE. I appreciate that. Let us turn to the Navy, then. In a recent memo to the Office of Management and Budget, the Navy General Counsel Steve Honigman warns that, "without movement toward an interim storage facility, the State of Idaho may block additional shipments of Navy spent fuel and the Navy will follow Russia's lead of tying warships to the dock because they cannot be fueled." Do you agree with Mr. Honigman's assessment, and do you agree that tying ships to the dock will demonstrate our unwillingness to address this national problem?

Mr. GRUMBLY. First, you have to ask Mr. Honigman about what he meant in his letter, but I would say this, that for 40 years the Navy has been able to count on the State of Idaho for being able to store its fuel. As you know, Senator, 60 percent of the Nation's nuclear deterrence capacity is in those nuclear submarines that we have. In these days and times, things like the carrier Nimitz, which are scheduled to be refueled in the coming years are critically important.

I know for a fact that the Navy will have a difficult time. I do not know that it is impossible, but they will have a very difficult time dealing with the defueling and refueling of several major naval vessels during the next couple of years, if they cannot continue to send fuel to Idaho.

Senator KEMPTHORNE. Secretary Grumbly, what steps can this committee take to ensure the opening of WIPP no later than 1998? Do you have, let us say, changes that you can recommend to the committee?

Mr. GRUMBLY. I would suggest, Senator, that the 1998 deadline that we are on is an ambitious one. Therefore in order to tie the Department of Energy and the Environmental Protection Agency to it, because with the Land Withdrawal Act of 1992, the Environmental Protection Agency became, essentially, the group that has to approve this, I would suggest that you give serious consideration to putting us on schedule with milestones over the next 4 years, so that we meet all of the things that we need to meet in the law in terms of submitting our application to the Environmental Protection Agency, and getting the Environmental Protection Agency to act on that application.

Senator KEMPTHORNE. Do you believe WIPP will open in 1998?

Mr. GRUMBLY. Absolutely, I believe WIPP will open at the end of 1998. I believe the next Secretary of Energy—and I only say "next" because Secretary O'Leary keeps telling me she will not do the job for more than 4 years—is going to be faced, you all are going to be faced, with opening that institution. I personally think that on the basis of the work that we have done, that it ought to be opened, that it represents major progress in dealing with transuranic waste. But I think that Congress should put us on a schedule to make sure that it happens, or at least make sure that the administrator of the Environmental Protection Agency makes a decision.

Senator KEMPTHORNE. Right. I appreciate that. In the Galvin Report, Dr. Kendall contends, "vast amounts of EM funds are being misspent." What I am wrestling with is that sort of a statement with data to back it up and your statement, Mr. Grumbly, of a "train wreck," because of the fact that we do not have enough funds to carry out the cleanup at these sites. How do we square this? How do we balance the need to reassess efficiency in the EM program with the need for stability in the EM program?

Mr. GRUMBLY. Well, I think the best way to do it is to fund the President's budget for the next 5 years. I mean, this budget by intention ramps this program to a level that I think will enable us to achieve the most for the dollars spent. We are already on the way of making this program over the next couple of years a lot more efficient in line with both the Galvin Report, as well as other reports that we have.

We are recompeting every single major contract that we have in the system and making them performance-oriented. We just signed a new one with Rocky Flats, in Colorado, last week. Those companies will make no money if they do not achieve the very ambitious safety and results-oriented objectives that we have. I believe that the amount of money that we propose for 1996 through 2000 is a schedule that is ambitious, requires regulatory reform, business reinvention, and will enable us to achieve the important goals that we have.

Senator KEMPTHORNE. Mr. Grumbly, I have written letters supporting it in the President's budget.

Mr. GRUMBLY. And I appreciate it very much.

Senator KEMPTHORNE. The final follow up to that, then, Dr. Kendall, while we are talking dollar amounts, are you comfortable with all of the directions that are contained in that budget or that continues down the path of not accomplishing the cleanup because too much money is going for administrative costs, taking care of just maintaining the waste instead of cleaning it up?

Dr. KENDALL. I cannot judge from that budget what the performance will be in the years ahead. I think only time will tell if the corrective measures are put in place and are as effective as we think they should be.

Secretary Grumbly clearly understands the criticisms that we have made about the management and regulatory excess in the Department and it will have to be seen whether they can be cut back.

Let me add a comment on an earlier remark on the WIPP site, which will deal, as he said, only with transuranic waste and not spent fuel. It is undersized by a factor of two to three for the current inventory of transuranic waste just in the Defense program system, and undersized by a factor of five to six for the aggregate transuranic waste in the entire nuclear program in the country.

Senator KEMPTHORNE. Doctor, I appreciate that data.

Secretary Grumbly, not only did we hit our goal of five questions, we hit seven. I appreciate it.

Mr. GRUMBLY. Reinvention.

Senator KEMPTHORNE. Yes.

Senator KEMPTHORNE. Senator Glenn.

Senator GLENN. Thank you, Mr. Chairman. Mr. Grumbly, Pantex was shut down for about 5 months during 1994 for various problems, I guess, resulting in only about half the planned weapons actually being dismantled. What is the current status there. Was the shut-down due to inadequate facilities or was this a technical problem? What is the status?

Mr. GRUMBLY. I believe it was a technical problem, but, Senator, I will have to get you a response for the record. Because in the interesting way in which the Department of Energy works, I do not have direct responsibility for Pantex.

Senator GLENN. If you would, I would appreciate it.

Mr. GRUMBLY. Yes, sir.

[The information follows:]

In April 1994, the Managing and Operating Contractor of the Pantex Plant, Mason & Hanger-Silas Mason Co., Inc. placed the operational facilities into a maintenance mode. This was done in order to update maintenance and safety documentation and to expedite completion of initiatives to improve conduct of operations and the maintenance of safety systems. All the facilities associated with dismantlement were placed into operation by July 1994. In 1994 Defense Programs dismantled 1,369, out of a projected 2,000, warheads. Since that time there have been several instances where dismantlement lines of specific weapons were halted until procedures could be changed or clarified to address specific issues. However, the entire dismantlement operation at Pantex was not halted during these periods since other weapon dismantlement operations continued. At present, all weapon dismantlement lines are operational.

Senator GLENN. Let me be parochial for a couple of minutes here. We have three facilities in Ohio—Fernald, Mound, and Portsmouth. We have the budgeting pretty well set for those, or we thought we did anyway. I think the Secretary's decision was to reduce by about $10.6 billion overall for over a 5-year period, $4.4 billion of that money came out of cleanup, which is regrettable. I can understand the problem she is in, but I just hate to see money taken out of cleanup.

Out of that $4.4 billion cut over the next 5 years, we take about a $1 billion reduction in Ohio on our three sites, I believe, if my figures are correct. Ohio EPA is estimated that if Fernald's funding was maintained at the 1994 level, $300 million, the cleanup could be completed within 10 years at a $3 billion cost. If the proposed budget goes into effect, the cleanup will be extended for 20 to 30 years, and cost in excess of $5.4 billion. I know we face the same kind of problem all over.

We have similar figures at the Mound. The Mound cleanup money going down $65 to $50 million in fiscal year 1995; fiscal year 1996, $55 million; fiscal year 1997, $46 million is the plan. Yet, some of the studies, I think, have shown that it if it was increased 10 percent, we probably could take care of all of the Mound problems somewhere around the year 2000, or very shortly thereafter. Are you giving consideration to some of those things?

Mr. GRUMBLY. I think you have illustrated an important problem. Fernald and Mound are probably the two places in the complex that we have a hope, first of all, of returning to something resembling the way it was.

Senator GLENN. We can wind them up in fairly short order if we would put just a little bit extra into them, rather than delaying it.

Mr. GRUMBLY. There is clearly a possibility on either a 7- or 10-year expedited basis of dealing with Fernald. I think you are right in terms of the year 2000. The issue is going to be, given all the competing demands, can we muster those resources? Second, it does seem to me that generically you raise the issue of when we see opportunities being able to wield and muster our resources in those areas where we can really make a difference. With all respect to my friends in the State Department of the Environment in Ohio, they, like all of the other places, everybody wants theirs now.

Senator GLENN. Sure, I understand.

Mr. GRUMBLY. I think part of our strategy has to be to somehow get the States to not look at this as an every person for themselves strategy, but to look a little more collectively at that. I know that is what you all are for in some ways.

Senator GLENN. What I am pointing out, and I am not trying to be super parochial here, but just a little bit parochial. [Laughter.]

You do reach a point, you reach a point in progress on each one of these things where a little more money could wind it up, and you would be done with it. I think the figures on Fernald here showed that they felt that extending it out, it was going to be about $5.4 billion, but if you wind it up sooner, it was going to be $3.3 billion, about $3 billion. It seems to me you do reach a point where a little bit of extra money invested really saves money, in the long haul. That is true in Mound as well.

Mr. GRUMBLY. It is true. Although, a little bit of extra money in this case is a billion dollars. Please help me. [Laughter.]

Senator GLENN. Please, you help me.

Mr. GRUMBLY. Yes, sir. [Laughter.]

Senator GLENN. No, I understand the problem that we are all facing on this. I just think there is a time, though, when whether it is Idaho or Ohio or wherever where a little bit of extra money can wind the whole thing up and save money, and I think maybe it is well worth considering doing that. I would ask you to look at that.

You indicated that of this cut that was required to be made, about $4.4 billion comes out of the overall budget, out of that $10.6 billion cut, over a 5-year period. You have indicated, I believe, that increased deficiencies can deal with about 20 percent of the cut and the remaining $3.5 billion can be renegotiations or it can be work source reductions, and so on. These efficiency cuts saving that amount of money, I am always a little dubious of. Can you detail that a little better? Can we plan on that? Or, is that something you just hope for?

Mr. GRUMBLY. I think in this area we have sufficient opportunities, and both Dr. Kendall and Mr. Galvin have pointed them out about reducing really unnecessary overhead across the entire Department of Energy. I personally believe very strongly in the economic man, which is to say if you give companies—most of our money is spent through companies—if you give them the incentive that you are going to reward them for high-quality performance, including saving the government money, the taxpayer money, that they will perform.

What we have done in the past, Senator, is that we have let these companies perform on a cost-reimbursable basis in which they get rewarded for spending more of the taxpayer's money. We should not be surprised that we have the most expensive system known to mankind, when the economic incentives that face corporations almost demand that they spend the taxpayers' money. I believe that as we recompete this $30 billion worth of contracts and change them to performance-oriented contracts that have the right economic incentives in them that we will drive down the cost of the system dramatically.

Senator KEMPTHORNE. Senator Glenn, since it is just the two of us remaining, which reminds me of our mandate, in the early morning hours the two of us on the floor together, if you have other questions, if you would like to continue, and let us just wrap up the questions.

Senator GLENN. Well, I just have one comment. My time is up now, but just one comment. In support of trying to get more money for you for these purposes, the chairman and I and Strom Thurmond, Larry Craig, Craig Thomas, and Patty Murray, all Senators, sent a letter on the 19th to the Budget Committee, asking them not to cut back on these areas, to expand the money in these areas, to get money back into them again. We are not going to see a 75-year cleanup at the rate we are going. My objective years ago was to have $9 to $10 billion to get it fairly solid, so you really could plan things that make the best use of money. At that point we thought you could not use much more than that constructively. So far, we have had Department of Energy cleanup start out at in 1989 at $1.7, $2.3, $3.6, $4.3, $5.5, $6.1, $6.1 billion, and we have not even gotten close to it. We are not going to get things cleaned up in 75 years even, unless we can get a more decent appropriation. That is what we were talking about in the letter we sent. I would be glad to give you a copy of that.

Mr. GRUMBLY. Thank you, Senator. I might add in hearing those signatures, that is the first time I have heard Senator Thurmond and Senator Murray on the same letter, and I congratulate you. [Laughter.]

Senator GLENN. The Chairman has powerful persuasive powers.

Senator KEMPTHORNE. To bring people together.

Senator GLENN. Absolutely.

Senator KEMPTHORNE. Senator Glenn, thank you for your questions. I know that you use the term "parochial," but I really believe regardless of where these facilities are sitting, if they are sitting in Idaho, the fact that Idaho is receiving shipments of spent fuel from a variety States—from the Navy, from foreign countries—we are not being "parochial." We are trying to come up with a national solution here.

Mr. GRUMBLY. Could I? I would like to endorse something that Dr. Kendall said about this. I think the kinds of systems analysis, which he called "synoptic analysis," is something that we really need to do, so that people in Idaho and people in Ohio understand much better how when you push on one place in the system it affects other places in the system. We really do need to link these places together a lot more.

Senator KEMPTHORNE. Yes, Senator Glenn.

Senator GLENN. I just have one more question. Are you still firmly wed to deep geologic storage. I have always had my doubts on this. I have been looking at this thing for many years. With all of the problems in geologic storage in shipping things to Yucca Mountain and shipping waste to WIPP and shipping waste all over. I have never been 100 percent convinced that we would not be better off taking smaller areas where they are to—you may find this stuff useful someday.

I don't know, maybe we will and maybe we will not. I think that it would be compared with doing great underground sites and the billions of dollars required to do that stuff, and put it down there with maybe geologic shifts and resulting problems someday and up comes radioactive stuff and evacuate half a State. I have always thought it maybe a little bit safer to do surface storage and monitoring. This approach will be expensive too. Is that still being considered or are we wed to deep geologic storage at this point?

Mr. GRUMBLY. Well, I think as a matter of policy what we are wed to is that Dan Dreyfus and his civilian radioactive waste colleagues have to tell all of you within the next several years whether they think that geologic repository is safe. My basic concern is as much as anybody can state, I need someplace or some way to get a final disposition of this material. Whether we need to think about that in kind of the 10,000-year timeframe that people have talked about or whether we can bite this off in somewhat different segments, I tend to be kind of more of a mind to view. Let us not be so arrogant to think that we can come up with a solution that is going to last for thousands of centuries.

Senator GLENN. I guess I tend to think of an iron fence concept within a green field concept. Where we have some of this, maybe you have to take a tiny area and just guard it. It is there to serve as storage, you monitor it in the future, and that is it, without shipping stuff all over and endangering people all across the country. It is time for another argument on that.

Senator KEMPTHORNE. Well, no, it is very pertinent. In fact, as Bill pointed out, Idaho would be willing to share some of its wealth in distributing some of our nuclear waste with 49 other States.

Mr. GRUMBLY. Well, when we find out that it is great for energy, you will be glad you have it.

Senator GLENN. If any of it is still on the surface, so you can still get to it. [Laughter.]

Senator KEMPTHORNE. If I may, I would like to complete my remaining questions, and then I want to get to Mr. Conway. Mr. Grumbly, when I completed my last set of questions, we were talking about the stability of the Department of Energy with the budget, with regard to budget. We were talking about stability. The Secretary of Energy's 5-year budget plan, which came out after the fiscal year 1996 President's budget request says that the Department of Energy plans to taken $1.2 billion to $1.4 billion in fiscal year and the following years from the total of the defense program in the EM. Now, will this come from you? Will this come from Dr. Reis? You talk about stability and predictability, and yet we are told another $1.2 billion to $1.4 billion may be redirected?

Mr. GRUMBLY. Well, as I understand it, if you take a look at the ramp down that we have, the $4.4 billion reduction that Senator Glenn was talking about, that is definitely factored into that ramp down. Those numbers are below the pre-December 1994 Office of Management and Budget estimates. I think that an educated person looking at those numbers would indicate that there is still a shortfall from the entire defense side of the Department of Energy that somehow is going to have to be made up. Personally, my argument to the Secretary and to the President and his people is that "I have given at the office."

Senator KEMPTHORNE. I appreciate that, but we are talking stability. We are talking a life of 10,000 years on this material, and yet we are told that next year we may see $1.2 billion redirected elsewhere?

Mr. GRUMBLY. Oh, not out of this. I think this program, obviously, the President's budget request, I am sure will be conditioned by what the ultimate appropriation is that comes out of Congress. We are fenced off in the Department at the moment under the Office of Management and Budget budget targets. I mean, the target that they have given us for next year, which is $6.3 billion, is a target that I believe will stand. I believe that very firmly, and I believe that I have a commitment from the Secretary that that target will stand.

Senator KEMPTHORNE. In the material that you submitted to us for this hearing, you gave a synopsis of what the recommendation was in the Galvin Report, what the action taken by the Department of Energy was, and then your review of that. I want to take just one of those. One of the recommendations was improvements in Department of Energy management and leadership are needed.

The action taken: the Department of Energy said "completed" and said the Department has hired more than 1,200 new employees to provide needed management capabilities. Your response to that was, "one persistent difficulty flagged by the Task Force was that there were already too many managers." The Department of Energy's response to your recommendation was we are going to hire more managers, and part of your report said they already have too many managers. How does this square?

Dr. KENDALL. Well, it does not square obviously. We certainly must disagree on this.

Mr. GRUMBLY. We do.

Dr. KENDALL. Bob Galvin may have something to say about this, but one of the problems that has raised costs enormously in the national laboratory is in many cases almost totally redundant management systems on some big project. It was a recurrent complaint to the Task Force subpanels that visited the national laboratories that many activities are double-managed. It was the source of the comments and the criticisms in this area that permeate the Task Force report.

Senator KEMPTHORNE. Dr. Kendall, how do you believe these deficiencies can be corrected? What can you tell this committee, so that we can set about correcting it?

Dr. KENDALL. This committee will have to look in detail into the management structures as they exist. The problems are outlined in the Task Force report. The committee can inform itself in detail as to how those have become manifest in the laboratory. The associate directors of places like Livermore and Los Alamos briefed us, showing excess costs coming from not dozens, not hundreds, but in some cases thousands of compliance requirements which they felt were unnecessary, the result in numerous instances of too many managers and too much management. It is in the national labs that the detailed documentation of that exists, from which sprang our criticisms in the Task Force report. Yes, we certainly knew about this, and it does not square. In many cases there are simply too many managers.

Mr. GRUMBLY. Mr. Chairman, you have to give me an opportunity to respond to this, please.

Senator KEMPTHORNE. Well, hang on just one second.

Mr. GRUMBLY. Okay.

Senator KEMPTHORNE. Dr. Kendall, also as I look through this—the recommendations, the action taken, comments, from those who serve on the committee, are you satisfied with, indeed, how the Department of Energy received the Galvin Report and implemented the recommendations, or do you feel that we are still a long way between what you recommended we should be doing and where the Department of Energy actually has gone?

Dr. KENDALL. Well, the systems and the problems that we are dealing with are so ponderous that it would be impossible in the 2 months since the Galvin Report was released to see the major changes that will be necessary. Those will simply have to be worked out over months and years before one can see accomplished really extensive benefit. Some of the new directions that Secretary Grumbly has outlined go toward meeting our comments.

However, some of what Secretary Grumbly has indicated suggests that the Department of Energy's response, that you quoted from my written materials, is not totally accurate. It is not the case, contrary to the Department of Energy's statement, that improvements in Department of Energy management and leadership that are needed, are now completed. They certainly are not at this time, in my opinion.

Senator KEMPTHORNE. Okay. I appreciate that. Let me give you a specific example of why enhanced Federal leadership, not micromanagement; I think you are right on the micromanagement, but why enhanced Federal leadership is absolutely necessary in this program. I will use Los Alamos National Laboratory as an example.

For 5 years, Los Alamos carried a remediation target that said, here, it is going to cost us $2.1 billion to clean up Los Alamos National Laboratories. This was the lab's own estimate. We sent a small but highly skilled task force to work cooperatively, not in a me mode, cooperatively with the labs to ask the question, "Gee, this cost seems a little high to us. We have some real questions about whether it should cost you that much."

Why not try a different approach? Let us look at the cost estimates that are here. These are people that we were able to recruit who had the kind of quality credentials that you need to have in order to adequately deal with environmental remediation, which we have never had. In the space of four months, Los Alamos on its own came down in its estimate of cleanup from $2.1 million to $700 million.

They did that because they work cooperatively with the Federal managers who were in the game to change the estimate, because we showed them better ways to do it, more cost effective ways to do, what the private market would actually charge if it was involved in that.

I mean, in the environmental area, particularly in the operations area of the environment, the labs do not have much knowledge of actually how to clean up. They have a lot of knowledge on the technology side, a lot of knowledge on the scientific side.

But, when it comes to the nuts and bolts of what Senator Exon was talking about, actually cleaning up, they really do not know very much. Only by having outstanding Federal managers involved in this were we able to do the job. In one place we saved $1.4 billion over the original estimate. Now, that is the kind of leadership that I think we need to employ.

On the nuclear safety side, you will hear from Mr. Conway the necessity that we have more high-quality people on nuclear safety, more feds, who are qualified. He may argue with whether we have enough qualified people or whether the people we are hiring are not the right folks, but there is nobody who works in this system now who does not know that we are hanging by a thread in terms of qualified feds to oversee the most dangerous materials in the world. When we are talking about improved management, I am talking about bringing on line people who are skilled in the nuclear safety area and in the environmental safety area, both to make this complex safer, as well as to save the taxpayers' money.

Senator KEMPTHORNE. The remaining questions, we can do these in about 3 minutes. In March I wrote a letter to President Clinton opposing the use of Department of Energy EM funding to characterize a nuclear naval facility in Estonia. Last week, I received a response stating that EM funds would be used for this important policy objective. If the Department of Energy has budget problems and cleanup commitments in the United States are in jeopardy, why are EM funds being used for foreign policy objectives? Also, did you support or oppose the use of your budget to pay for this activity?

Mr. GRUMBLY. If it would be all right, I would like to give you 30 seconds of history on this, just so that the record is clear. In July 1994, the Vice President met with the Minister of Estonia, the Foreign Minister of Estonia, who said in the aftermath of the Cold War that it would be extraordinarily useful if the United States could make some progress in helping get the Russians out of Estonia.

One of the big issues is Soviet submarine refueling at a reactor base in Estonia. The Vice President said he would try to help. The Vice President wrote to Secretary O'Leary asking if the Department of Energy, because we have the technical capacity to help, if we would. We were very conscious of the problem of not spending domestic cleanup funds on international activities. We said we cannot spend any money on the actual cleanup, but we will provide $2 million in kind, in terms of expertise, to try to help characterize this problem that is at this place called Paldisky, to deal with risk, and to test a technology for low-level sludge treatment in one of these tanks that we think can be useful at Hanford and at Savannah River.

We did move forward to do that. No cash has changed hands. It has all been people, including a quarter of a million dollars' worth of help from the Idaho National Laboratories. I think that we are going to get something from that. We are going to get scientific knowledge. We are going to get knowledge about a particular technology.

I think it is appropriate for the United States to be involved with that. To the extent of where the money should come from, it has been my view, that while we have the expertise, that this is a problem that needs to be shared at the very least across the Department of Energy.

We are energetically looking to make sure that we do not have to carry the money for the whole boat. I think the letter that you received back from the Vice President—or from the President, rather, is a letter that was basically trying to support the activity, but without having full knowledge of what we are trying to do to underpin the funding of this.

Senator KEMPTHORNE. And the price tag?

Mr. GRUMBLY. The total price tag over several years will be no more than $2 million. We have spent $225,000 to date. We have gotten enormous good will with a country that historically and in the future will be very important to the future of Eastern Europe. We have obligated about $800,000. Some of that money has been spent by people who are in your home State, who are making a contribution to this. These costs have not delayed any cleanup activities that we would have in Idaho or anyplace else.

Senator KEMPTHORNE. So it is good foreign policy?

Mr. GRUMBLY. I think it is good domestic policy in the following sense. We are getting a chance to test an advanced technology someplace else that we think will be useful to us in the future, and also to test how to do risk assessment, which is something that we are going to have to do a lot more of.

Senator KEMPTHORNE. As you know, I strongly support efforts to develop technologies to deal with the long-term disposition of spent nuclear fuel. In this area, are you familiar with the electrometallurgical technology that Argonne is developing to treat the Department of Energy's spent nuclear fuel, and also are you aware of the National Academy of Science's interim report recommending continued development of this technology?

Mr. GRUMBLY. Yes, I am—I mean, I am not familiar at the very specific technical level, but I am familiar with the Academy's report.

Senator KEMPTHORNE. Do you support that technology?

Mr. GRUMBLY. I support the report of the Academy that says we ought to continue to pursue this.

Senator KEMPTHORNE. Okay. And, finally, Secretary Grumbly, the State of Idaho is concerned that interim storage of spent nuclear fuel, as recommended by the Department of Energy EIS, may extend well beyond 40 years. Can you tell me today if all of the spent nuclear fuel destined for the Idaho National Engineering Laboratory will go into the first repository, or is it true that the Department of Energy does not know if the spent fuel in Idaho will meet the NRC requirements, if there is enough volume at Yucca Mountain for the Department of Energy spent fuel, or if Yucca Mountain will ever open?

Mr. GRUMBLY. That is a multipart question. Starting with the last, of course I do not know whether Yucca Mountain will ever open. Any other answer would invite derision, I suppose, at this point.

Senator KEMPTHORNE. You have given me honest, straightforward answers. But do you see why we are leery of the term "interim storage"?

Mr. GRUMBLY. Well, of course I understand that. One thing that I can say is that I think anybody who is in this business is legitimately concerned about this, at least until we can demonstrate that we can open WIPP. Until we can even open something for transuranics, and I agree with Dr. Kendall that it may not be big enough—but, jeez, let us try to open the first one, before we start worrying about the second one.

Now, if you have a right to be legitimately concerned? I think that the EIS that we just put out is designed to ensure that the material will be able to go in to the repository. All of our policies are based on the assumption that there will be an ultimate repository, or repositories, given Senator Glenn's view, an ultimate repository for this fuel. That is what we are diligently working toward.

Senator KEMPTHORNE. Secretary Grumbly, and Mr. Galvin, and Dr. Kendall, thank you very much. It was a very helpful discussion. We also thank you for the role you are playing in trying to find a solution to the problem.

Mr. GRUMBLY. Thank you all very much. I appreciate it.

Senator KEMPTHORNE. We will take just a 3-minute recess. [Recess.]

Senator KEMPTHORNE. Thank you very much for joining us today. Before we begin, Mr. Conway, could I ask that perhaps your colleagues would—we would just like to meet them.

Mr. CONWAY. I am going to introduce them, if I may?

Senator KEMPTHORNE. That would be very helpful.

Mr. CONWAY. Dr. A.J. Eggenberger, who is the Vice Chairman of our Board; Capt. John W. Crawford, Jr.; Joseph DiNunno; and Dr. Herbert Kouts. All of the members of the Board, with the exception of one, have been a member of the Board from its inception. Mr. Joseph DiNunno, who joined us shortly after the death of one of our original members, has been of tremendous assistance to our Board. He is an excellent member, and brings to the Board a great deal of safety knowledge in nuclear fuel as well as environmental knowledge. He has many years of experience and a background in environmental matters. He has been a great addition to our Board, and we are very pleased to have him.

Senator KEMPTHORNE. Mr. Conway, thank you very much, and all members of the Board, thank you for your tremendous service that you render in that capacity. I would just note that the Defense Nuclear Facilities Safety Board has important external oversight responsibilities for a number of Department of Energy activities.

In the past, the Board has made a number of useful recommendations that have addressed health and safety concerns. In addition, this committee played a key role in the formation of the Defense Nuclear Facilities Safety Board and look forward to your testimony, Mr. Conway. At this point, any comments that you have we welcome.

STATEMENT OF JOHN T. CONWAY, CHAIRMAN, DEFENSE NUCLEAR FACILITIES SAFETY BOARD; ACCOMPANIED BY DR. A.J. EGGENBERGER, VICE CHAIRMAN; CAPT. JOHN W. CRAWFORD, JR., BOARD MEMBER; JOSEPH DiNUNNO, BOARD MEMBER; AND DR. HERBERT KOUTS, BOARD MEMBER

Mr. CONWAY. Thank you, Mr. Chairman. I really very much appreciate the kind words that Senator Exon made earlier with reference to the Board. We do look upon this committee, and also particularly, Senator Glenn, who through his service on this committee, particularly the subcommittee, and his chairmanship on Governmental Affairs has been, if not the father of this Board, one of the strongest supporters of having this Board formed through his work, as I say, in Governmental Affairs, as well as his work here on this committee. We thank him for his efforts.

My prepared statement has been submitted and I would like to, with your permission, have it introduced as if read, rather than reading through it.

Senator KEMPTHORNE. Certainly.

Mr. CONWAY. Also, if I may also include by reference, just by reference, our Fifth Annual Report to the Congress which we were required to submit by law, a law that had its origin in this committee. Included in our Fifth Annual Report is a review of the work we have done during the past 5 years, and what we think the needs may be for the future for this Board.

I would like to pick up with some of the points that were made by the previous panel and possibly respond to some of the questions that were asked, that may not have been completely answered. For example, Senator Glenn asked about the shutdown at Pantex. Mr. Grumbly, of course, I guess his bailiwick in Defense Programs, but we did have technical staff at Pantex at the time of the shutdown. The shutdown was determined both by the contractor and the Department of Energy people on site. It was their determination and we believe it was a proper determination; they did the right thing.

It was a difficulty they found as they were preparing to take apart one of the new models, a new model as for disassembly. With that particular weapon that they were preparing to take apart, the ventilation system and the procedures in which they had to maintain this defense objective were not as they thought. In fact, as I recall, there may have even been a failure to proceed on at least one of the laboratory personnel present.

We watched this discussion here today with the panel on the Galvin Report. I would like to submit a fairly short for-the-record, at this point, if it is agreeable with the committee, the Board's comments on the Galvin Report. There was much of it that we agreed with, very definitely. Obviously, our comments have to do with the safety issues. There is much, undoubtedly, having to do with Department of Energy review, if you will, with procurement policies and matters of that nature that, undoubtedly, need to be liberalized.

We disagree, however, that one could suddenly set up some kind of a corporation and turn over to this corporation the monies, taxpayers' money, and not have outside oversight, particularly in the safety area. I am only talking in the safety area. This Board is a strong proponent of maintaining viable laboratories. We want to continue to see the capability that currently exists. We do not want to see that disappear. In fact, a number of the recommendations we have made to date—we have made 31 sets of recommendations—to the Department of Energy, constituting 139 specific recommendations. Many of the recommendations we have made are to strengthen the laboratories. One, in particular, we found out that through lack of money they were going to have to close down their capability of doing criticality studies. We thought that was wrong. One of our major recommendations was to assure that adequate funding would go on for their continued work in criticality studies. Fortunately, I am glad to say, the Secretary accepted our recommendation and has assured us that that is going to take place.

We have also been a strong supporter of maintaining technical competence within the laboratories. We were concerned that we were losing some of that technical competency, and particularly with the retirement of many of the weapons personnel that have intimate knowledge about design weapons, that we were going to lose that.

We made recommendations on how we can utilize the personnel that have this knowledge, even though they are retired, to bring them back and make sure we can get their knowledge down and documented for future laboratory personnel. We are fearful that this technical competence may be evaporating. However, again, I am sorry to say that there is need for supervision—independent oversight—for safety reasons at the laboratory level. Again, I say this because I do not want to see those laboratories lose their capabilities.

We have found, for example, even in the low-level waste area, they are not following the same requirements that are imposed on civilians outside the government in waste removal and on waste storage personnel. We think that they should be brought up to at least that same level. Why? Because if they don't do that and most communities find out they are not even meeting the minimum requirements that are imposed upon the civilians, we can see some opposition developing. We do not want to see that.

For example, I do not want to support the 1,200, or whatever the number he may come down with, that Grumbly comes down with, as far as the exact number of personnel. We think it is important that they get technically competent people. Personally, I do not think, and I think the other Board members do not think, we need that many. We certainly need technically competent personnel, and we have not been getting them.

Congress, I think, has been very good—this particular committee, for example—last year in the authorization legislation supporting this excepted service that gives the Department of Energy the capability in defense areas to hire personnel without all the restrictions that are normally imposed with civil service rules and regulations.

We, as a Board, have been a proponent of that for a number of years, and finally that legislation was passed last year. As of now we are not happy that they have not properly used it. The last call as of yesterday, the last check, they have only utilized that authority to hire 10 technically competent people, that we would say were technically competent to go into the defense area of their work. We think they could make better use of that.

I do not know how competent are all of the individuals that Tom Grumbly was talking about, but those that are in the excepted service are where they can make use of them. We, as a Board, are watching that and reviewing the technical capability of these people. One of our Board members was down at Pantex this past week. He came back on Friday and reported that more than 6 months ago the Albuquerque office responsible for an overview of Pantex had requested eight specific individuals be assigned under excepted service. It is still sitting up there, unfortunately at Department of Energy headquarters. We determined this morning that we are going to Department of Energy headquarters and find out why they cannot move faster on it. That is what they need—technically competent individuals.

Senator GLENN. Can I ask a question?

Mr. CONWAY. Yes, sir, please do.

Senator GLENN. Would that contribute to the problem at Pantex, the lack of these qualified people?

Mr. CONWAY. No, because in that case the Department of Energy personnel right there observed it and understood what the problem was. But it does come into a problem at Pantex to the extent that they needed discipline of operation. They have been making tremendous improvements, we believe, at Pantex, coming into a discipline management of operations concept. They still have more to go. This is one of our key areas that we have been focusing our attention on. The objective is to have disassembled over 2,000 weapons per year. That was the first site that this Board selected to assign a site representative.

In fact, we picked up an individual who was being retired from Los Alamos, who had spent 40 years, with his main responsibility the safety of disassembly of Los Alamos' weapons at that particular site of Pantex. We hired him, and then we had him mentoring another younger man who was down there. We have two site reps at Pantex because we do think it is very important. We also see Hanford as another major place we have problems.

Let me say this. Tom Grumbly, in my opinion, over all the years I have served in both the government and private industry, I find him to be one of the most conscientious, hardworking individuals that I have been privileged to come in contact with. He has an almost impossible job, handling the amounts of money he is handling and with all of the various pressures that are put upon him at these various sites. But, when we talk about decommissioning and restoration, if you will, of this land, there are several facets that have to be taken care of first.

First of all, production has to cease at a building or a facility that has to be decontaminated. There may well be a great deal of material, highly radioactive material, in unstable conditions. That has to be stabilized, even before you move it out of there. Once you get the material stabilized, then you have the problem of trying to decontaminate it.

Eventually, you have to decide, as for the systems approach, what we are going to do with that particular facility or material you get out. It is a major problem. You have to do this from a systems approach with each individual facility. We have thousands of facilities out there.

So, it is a matter of selecting on a priority basis. The Board can suggest you do it on a priority basis from a—what is the most hazardous right now? We have in our Recommendation 94–1 identified what this Board believes to be the most hazardous from the point of present danger to the workers at the plants because much of the material is in an unstable form.

Why is it an unstable form? Because back in 1989, when production was stopped, it was thought at that time it was only going to be a temporary period of time and the Department of Energy would resume operation, production. As time went by, material was put in short-term storage.

Then, as we move now into a new mission, we are no longer in a production mode, this material was put in temporary storage and was not intended for it to be kept in that situation or that condition for what has now numbered into years. The packaging is now decomposing and producing hydrogen. They constitute a present danger. This situation has to be taken into account first.

Tom Grumbly and also Hazel O'Leary have assured this Board that the recommendations we have made for health and safety reasons, and particularly those items that we have identified as being a pressing need to be attended to on a short-term basis, 2 years to 8 years, must be done, and will be given priority. I was very pleased to hear that you were attempting to get some more money for Grumbly, because he has promised to give us priority, "us" being the recommendations that this Board has made.

I would not want to continue to draw money away from these other areas that we do see out in the field. Some attempts at times to cut back, or justify a cutback, on some of the recommendations we have made are because of what they feel is a lack of funding. We are watching that very carefully, especially with the recommendations we think are essential and that need to be done in a prompt manner, that they are not put aside or slowed down because of a shortage of funds.

One other point. I think Dr. Kendall made some reference to the National Academy of Sciences responding to Senator Thurmond that they had looked at various matters of handling the plutonium in the fuel elements, and that it was not economical to reprocess the fuel elements. That is true. However, they pointed out there may be other reasons why you still would do it. They have that as one of the main possibilities, recognizing from a purely economic point of view it may be cheaper to produce electricity from present uranium.

However, when you look at all of the other courses of trying to dispose of the plutonium and the problems we have there from an economic point of view vis-a-vis the other alternatives, it may still be the better way of going. I think that might be clearer, if you did not want to leave an impression on the record that the National Academy of Sciences has taken a position against reprocessing these materials and utilizing the plutonium.

I do not want to take up any more time. I will leave myself open for questions. I think I have touched on the main points. I would like to say for the record I have written comments on the Galvin Report, and I would request that you make it part of the record, sir.

Senator KEMPTHORNE. Yes, without objection. That would be very helpful to us. Also, let me take care of one other matter. We will also make Senator Exon's formal comments part of the record in the appropriate place.

[The prepared statement of Senator Exon follows:]

PREPARED STATEMENT BY SENATOR J. JAMES EXON

Thank you, Mr. Chairman. I join you in welcoming Mr. Conway, the Chairman of the Defense Nuclear Facilities Safety Board, to today's hearing. The Defense Nuclear Facilities Safety Board was created in legislation drafted by this subcommittee and enacted in the National Defense Authorization Act for Fiscal Year 1989 (Public Law 100–456). We are here today because of subsection (d) of Section 1441 of that act, which requires the fifth annual report of the Board to include, and I quote:

"(1) an assessment of the degree to which the overall administration of the Board's activities are believed to meet the objectives of Congress in establishing the Board;

"(2) recommendations for continuation, termination, or modification of the Board's functions and programs, including recommendations for transition to some other independent oversight arrangement if it is advisable; and

"(3) recommendations for appropriate transition requirements in the event that modifications are recommended."

Mr. Chairman, I am proud of the role that this subcommittee, and this committee, played in the creation of the Safety Board, and I believe that the Board's actions over the years since its creation have shown the wisdom of the committee's actions. I look forward to Mr. Conway's testimony and recommendations.

Mr. CONWAY. Thank you, sir.
[The prepared statement of Mr. Conway follows:]

PREPARED STATEMENT BY JOHN T. CONWAY, CHAIRMAN; A.J. EGGENBERGER, VICE CHAIRMAN; JOHN W. CRAWFORD, JR., MEMBER; JOSEPH J. DINUNNO, MEMBER; HERBERT J.C. KOUTS, MEMBER, DEFENSE NUCLEAR FACILITIES SAFETY BOARD

Mr. Chairman and members of the subcommittee: We appreciate the opportunity to testify before the subcommittee on the health and safety activities of the Defense Nuclear Facilities Safety Board (Board). In our testimony today, we will summarize the Board's progress in fulfilling its public health and safety mission, and highlight our planned review activities.

INTRODUCTION

For nearly half a century, the Department of Energy (DOE) and its predecessor agencies operated the Nation's defense nuclear weapons complex without independent external oversight. In the late 1980s, it became increasingly clear to Members of Congress that significant public health and safety issues had accumulated at many of the aging facilities in the weapons complex. In September 1988, the Senate Armed Services Committee adopted a modification of Title I of the Governmental Affairs Committee bill (S. 1085), and the Defense Nuclear Facilities Safety Board was established in the National Defense Authorization Act for Fiscal Year 1989 (Public Law 100–456). The Board's principal means of effecting change at defense nuclear facilities was to be issuance of recommendations on health and safety to the Secretary of Energy, or in certain pressing circumstances, directly to the President. By the fall of 1989, the initial five members of the Board had been appointed by the President and confirmed by the Senate, and staff recruitment efforts were underway.

During the first 5 years of operation, the Board has made 31 formal sets of recommendations to the Secretary of Energy, totaling 139 specific recommendations. The Secretary of Energy has responded to, and accepted, each of these recommendations. The Board's recommendations result from: (1) site visits by the Board, staff, and outside technical experts; (2) review of documentation concerning particular problems at a site; (3) review of staff or Board contractor reports in appropriate cases; (4) briefings by DOE officials and DOE contractors; and (5) deliberation and technical review by the Board.

The Board has held a total of 43 public meetings or hearings in Washington, D.C., or in communities near defense nuclear facilities. These meetings provide opportunities for interested groups or persons, public and private, to express their views as to DOE facilities, directly to the Board members in informal and in open discussions near the sites.

The Board has also undertaken the added responsibilities mandated by the National Defense Authorization Act for Fiscal Years 1992 and 1993 (Public Law 102–190) which amended the original law. These amendments, which added the assembly, disassembly, and testing of nuclear weapons to the scope of the Board's health and safety responsibilities, increased the Board's workload substantially.

STATUTORY MISSION OF THE BOARD

The Board is responsible for independent, external oversight of all activities in DOE's nuclear weapons complex affecting nuclear health and safety. The complex is now engaged in cleanup (principally from radioactive contamination), disassembly of nuclear weapons as the Nation's stockpile of weapons is reduced in size, and maintenance of the smaller stockpile. There is increased activity in preparing to store fissionable material from disassembled nuclear weapons, and most importantly in stabilizing material that remains in the production pipeline, through which flow has been halted.

The Board reviews and analyzes facility and system design, operations, practices and events, and makes recommendations to the Secretary of Energy that the Board believes are necessary to ensure adequate protection of public health and safety. The Secretary may accept in whole or in part or disapprove the recommendations. The Board must consider the technical and economic feasibility of implementing the recommended measures, and the Secretary must report to the President and Congress if implementation of a recommendation is impracticable because of budgetary considerations. If the Board determines that an imminent or severe threat to public health or safety exists, the Board is required to transmit its recommendations to the President, as well as to the Secretaries of Energy and Defense.

The Board's enabling statute also requires that the Board review and evaluate the content and implementation of health and safety standards, including DOE's orders, rules, and other safety requirements, relating to the design, construction, operation, and decommissioning of DOE's defense nuclear facilities. The Board must then recommend to the Secretary of Energy any specific measures, such as changes in the content and implementation of those standards, that the Board believes should be adopted to ensure that the public health and safety are adequately protected. The Board also is required to review the design of new defense nuclear facilities before construction begins, as well as modifications to older facilities, and to recommend changes necessary to protect health and safety. Review and advisory responsibilities of the Board continue throughout the full life cycle of facilities, including shutdown and decommissioning phases.

The Board's enabling statute provides means to effect change through powers to conduct investigations, issue subpoenas, hold public hearings, gather information, conduct studies, establish reporting requirements for DOE, and take other actions in furtherance of its review of health and safety issues at defense nuclear facilities. These ancillary functions of the Board relate to the accomplishment of the Board's primary function, which is to assist DOE in identifying and correcting health and safety problems at defense nuclear facilities. The Department of Energy and its contractors at defense nuclear facilities are required to cooperate fully with the Board.

PUBLIC HEALTH AND SAFETY CONCERNS

During the past few years, unprecedented change in the mission of the Department of Energy's nuclear weapons complex has occurred. Production and testing of nuclear weapons have ceased. DOE has sharply curtailed processing of nuclear materials. Such processing as it is still done is to convert residue, semi-processed materials to more stable chemical forms for safe storage. Disassembly of thousands of nuclear weapons is proceeding. Many sites and facilities are being shut down and their facilities readied for decommissioning and decontamination, resulting in the start of a mammoth cleanup effort.

Changes in activities at the nuclear defense complex have had, and will continue to have, a significant impact on the Board's health and safety oversight functions. Many of the safety issues arising from these extraordinary changes involve operations and processes that are new to the nuclear weapons industry; others have never been addressed at all. Simply put, the process of "shutting down" many defense nuclear facilities compounds existing hazards involving handling and storing nuclear materials with additional hazards associated with cleaning up the facilities. If safety systems are not properly maintained, and other precautions are not taken, these facilities can pose an increasing risk to worker and public health and safety.

Many of the most difficult technical challenges and uncertainties result from the poor physical condition of facilities. As facilities age, maintenance becomes more difficult and more expensive. As experienced operating personnel leave, the knowledge of facility designs and contents erodes, reducing the margin of safety. The potential for detonation, fire, and corrosion hazards may increase as chemical compounds become unstable through time. Some existing radiological hazards may become worse as daughter radionuclides emitting more penetrating radiation accumulate (for example, americium).

Also, cleanup operations are rarely as routine or predictable as production operations. During the process of dismantling facilities, workers are more likely to come in contact, often unexpectedly, with radioactive and chemical materials that have been inaccessible for many years. Contaminants may be released to the immediate environment during the dismantling process. Shutting down and dismantling a defense nuclear facility can actually increase the risk of dispersal of radioactivity through material degradation, natural phenomena, fires, or accidental nuclear criticality. Therefore, special attention and care are required during these processes.

At the same time, many previously identified threats to public health and safety throughout the complex remain unresolved. These include, for example, uncertain characterization of the contents of, and leaks from, radioactive waste storage tanks; deteriorating nuclear reactor fuel in storage basins; potential safety problems of radioactive materials left in production lines; radioactive contamination of soil around former nuclear chemical processing facilities; unanticipated difficulties with weapons dismantlement; and deficiencies in training and qualification programs, in radiological protection, and in the conduct of operations. These have prompted a number of recommendations the Board has made to the Secretary of Energy. One of the most important of recent recommendations has been 94–1, which stated priorities for urgent action in remedying hazards that have developed from cutoff of defense production in DOE facilities.

Well-recognized and long-standing problems, accompanied by new activities, present different and potentially serious safety hazards to workers and the public. The reduction of weapons production activities at DOE facilities does not mean that safety management and oversight can be reduced. The reality is that independent technical oversight continues to be needed in order to ensure that both the workers and the public are adequately protected.

NUCLEAR WEAPONS HEALTH AND SAFETY ISSUES

In the weapons-related areas, the technical challenges facing DOE and the Board will change as DOE plans for changes in the complex. Major weapons-related issues requiring continuing attention include:

- Safe dismantlement of approximately 2,000 nuclear weapons per year in accordance with improved, standards-based methods;
- The requirement to provide substantially increased capacity for the safe storage of weapons-grade plutonium, enriched uranium, and other nuclear materials removed from weapons;
- Resizing of the weapons complex, and DOE's use of the Stockpile Maintenance and Stockpile Stewardship programs to ensure that nuclear safety is retained; and
- Significant losses of technical personnel experienced in operational safety-related issues, from a system that has been more "expert-based" than driven by formal conduct of operations.

The continuing national commitment to dismantle approximately 2,000 nuclear weapons per year will significantly challenge a DOE weapons complex that is experiencing a coincident erosion of technical capability while physical plant is being reduced. For example, DOE has experienced several technical and safety-related difficulties in dismantling W–48 weapon systems; these events have caused several significant delays while safety-related and other technical changes were incorporated in the disassembly procedures.

In particular, the loss of experienced weapons program personnel from DOE, and from the national weapons laboratories and contractor organizations continues to limit and significantly slow DOE's ability to address both systemic and site-specific safety problems. Dismantlement continues to be an important mission for DOE; problems with the conduct of dismantlement operations and with the definition and documentation of the safe operating envelope at the Pantex facilities continue to need attention.

The aging of the Nation's nuclear weapons stockpile presents unique challenges. Modifications may need to be made to extend the shelf life of today's weapons, and difficulties, as yet unforeseen, are likely to be uncovered during the weapons surveillance process. Such occurrences could have significant safety and reliability consequences.

FIFTH ANNUAL REPORT TO CONGRESS

On February 16, 1995, the Board submitted its fifth annual report to the Congress as required by its enabling legislation. This report presents a comprehensive review of the activities of the Board during calendar year 1994, including an assessment of the improvements in the safety of DOE defense nuclear facilities and an assessment of safety problems remaining at these facilities.

As required by statute, the Board also addressed three special issues in its fifth annual report. These issues are:

- An assessment of the degree to which the overall administration of the Board's activities are believed to meet the objectives of Congress in establishing the Board;
- Recommendations for continuation, termination, or modification of the Board's functions and programs, including recommendations for transition to some other independent oversight arrangement, if it is advisable; and
- Recommendations for appropriate transition requirements in the event that modifications are recommended.

In preparing to answer these questions, the Board conducted eight public hearings at locations in the vicinity of principal defense nuclear facilities, and a ninth hearing in Washington, D.C., where testimony was received from the Secretary of Energy and other high-level DOE managers. The Board's public hearing records document that the DOE, State and local governments, and the public believe the Board's external oversight function has been beneficial and should be continued. The Secretary of Energy provided the following testimony at the Board's public hearing held on December 6, 1994:

> I want to focus, first of all, on your key question, which might be whether the Board has assisted the Department of Energy in identifying significant

nuclear safety problems and helped us in correcting those problems. My response would be a resounding yes.

The Board deliberated on the adequacy of its current statutory authority in light of experience of the past 5 years, and whether that authority should be amended or eliminated. In summary, the Board concluded that:

- Independent, external oversight of DOE's nuclear safety management of the defense nuclear complex is a vital function worthy of continuance;
- The Board's existing statutory authority is sufficient to achieve congressional objectives in establishing the Board; and
- The Board, through the current recommendation process rather than a formal regulatory procedure, provides a cost-effective means for achieving the added safety assurance that the Congress, the administration, and the public seek.

CONTINUATION OF EXTERNAL OVERSIGHT FACTION

The Board believes that external oversight of the nuclear safety management of defense nuclear facilities is necessary. This need will remain so long as defense nuclear facilities continue to store, process or use radioactive materials.

It is widely recognized that those who use radioactive material must bear the primary responsibility for ensuring that there is adequate protection of workers, the public, and the environment. It is equally recognized that external oversight of safety management programs is necessary. It was concern about DOE's self-managed safety program, and the lack of independent oversight, that led Congress to establish the Board in the first place.

ENHANCING THE BOARD'S EFFECTIVENESS UNDER CURRENT STATUTE

The Board's statutory authority centers on making recommendations to the Secretary of Energy. The Board has experienced a number of problems with the recommendation process, particularly with achieving full and timely implementation of recommendations by DOE. The Board identified a number of means for exercising its current statutory authority more effectively. These include the following:

- Focus and maintain the attention of DOE top officials on correcting safety problems. Early and sustained involvement by high-level DOE officials responsible and accountable for progress enhances timely and effective responses to recommendations.
- Conduct hearings, and where appropriate, public hearings, to effectively elevate issues, focus attention, and increase accountability.
- Increase prompt dissemination of safety information to the public through increased use of public hearings.
- Provide additional onsite representatives, who will be instructed to interact with members of the public locally on a regular basis.
- Continue and extend avenues for disseminating information electronically to the public.

COMPLEX-WIDE SAFETY ISSUES REQUIRING PRIORITY ATTENTION

Within the broad context we have outlined, the Board plans to continue its emphasis on a number of safety issues across the defense nuclear complex. These include the need for the Board to:

- Oversee the safe dismantlement and safe storage of nuclear weapons and weapons components;
- Oversee the development and application of nuclear safety-related standards; assess their adequacy; and confirm compliance;
- Continue to review DOE's effort to integrate safety requirements contained in rules, orders, and elsewhere into a clear, coherent, and consistent standards-based safety program.
- Closely monitor DOE's upgrading of technical capabilities and expertise to ensure safety;
- Draw attention to the need for DOE to provide prompt, long-term and safe processing, packaging and storage of plutonium;
- Instill continued improvement in the safe conduct of operations by DOE and its contractors including developing and implementing comprehensive safety standards;
- Continue to review DOE's program for resolving ongoing nuclear safety issues associated with corrosion and storage of spent fuel;
- Help to ensure that DOE pursues excellence in the radiation protection program to protect workers and the public from nuclear radiation;

- Oversee the safe handling and disposition of nuclear waste materials and the control of releases to the environment;
- Oversee DOE's adoption of a systems approach to projects and programs to achieve cost-effective nuclear safety; and
- Assist DOE through the recommendation process in developing a cost-effective and workable safety management program that is marked by: (1) clearly defined requirements and expectations, organizational roles and responsibilities, basis for compliance and enforcement; and (2) related stability of both technical and management framework.

SITE-SPECIFIC SAFETY ISSUES

The Board plans to place a high priority on the following site-specific safety issues in fiscal years 1995 and 1996:

Fernald

- Safe stabilization of uranyl nitrate hexahydrate solutions.
- Implementation of the requirements of Recommendation 93–4 regarding technical management of this particular Environmental Management Restoration Contract.

Hanford Site

- Characterization of high-level nuclear waste in tank farms, and integration of overall Tank Waste Remediation System efforts using accepted systems engineering principles, including effective implementation of Recommendations 90–7, 92–4, and 93–5.
- Cleanup of corroding fuel in the K-East Basin, and removal of in-process hazardous material from Plutonium Finishing Plant systems.

Idaho National Engineering Laboratory

- Upgrading of Idaho Chemical Processing Plant fuel basins and associated safety bases.
- Disposition of remaining reprocessing solutions at the ICPP and review of safe storage of calcined waste.
- Safety of the Advanced Test Reactor (ATR).

Mound Site

- Unloading of tritium reservoirs, including readiness reviews, and the repackaging of uranium and plutonium materials in response to Recommendation 94–1.

National Weapons Laboratories

- Programs for ensuring safety of defense nuclear-related research and development activities.
- Revised safety analyses of facilities, with particular emphasis on analysis for seismic hazards at the Los Alamos National Laboratory and the Lawrence Livermore National Laboratory.

Nevada Test Site

- Establishment of a comprehensive process to prepare for and evaluate nuclear test readiness, including implementation of Recommendations 92–6 and 93–6.
- The design basis and the operational readiness of the new Device Assembly Facility.

Oak Ridge

- Conduct of operations and criticality safety at the Y–12 Plant, in response to Recommendation 94–4.
- Adequacy of nuclear material storage.

Pantex Plant

- Design and safety basis for the new Special Nuclear Material Staging facility.
- New and upgraded safety analyses to ensure technical adequacy.
- Revised requirements on overflights and analysis of safety of overflights.

Rocky Flats

- Processing and storage of various forms of special nuclear material (SNM) to meet the requirements of Recommendation 94–1.
- Implementation of Recommendation 94–3 for systematically evaluating the design of Building 371 for the storage of SNM.

Savannah River Site

- Startup and operation of F-Canyon, FB-Line, H-Canyon, HB-Line and spent fuel storage basins to stabilize various forms of SNM.
- Safety basis and readiness for start-up of the In-Tank Precipitation Facility and the Defense Waste Processing Facility.

SUMMARY

In summary, the DOE mission related to its defense nuclear programs has shifted significantly in recent years. Based on 5 years of full-time oversight work to ensure that public health and safety is adequately protected throughout the DOE weapons complex, the Board can attest to the seriousness of the technical, legal, and managerial problems faced by the DOE and its contractors. With the shutdown of many DOE facilities, the conditions and hazards being faced by DOE are potentially more urgent and present a more serious safety problem than when the facilities were in operation. These changes in the DOE nuclear weapons complex have made the Board's job more demanding, not easier.

If the DOE or any successor agency(s) is to be successful in meeting the technical and managerial challenges that exist today throughout the complex, a substantial increase in the caliber of scientific and technical talent must occur within the support contractor organizations and especially in the Federal staff. The Board has been concerned with the loss of unique talents from DOE and its contractor organizations caused by the down-sizing of the defense nuclear complex. This concern is particularly acute for the weapons laboratories and the facilities involved in the assembly, disassembly, and maintenance of weapons, where budget pressures and other constraints are leading to the severe erosion of the talent pools upon which much of the weapons program has depended. We emphasize that we are referring to quality of technical staff, not quantity. If adequacy of financial resources were the answer, the cleanup problem would be well on the way to solution.

Thank you for the opportunity to report to you on the Board's progress in meeting the challenges before us. We will be happy to answer any questions you may have.

DEFENSE NUCLEAR FACILITIES SAFETY BOARD,
625 Indiana Avenue, NW, Suite 700,
Washington, DC, February 22, 1995.

Hon. HAZEL R. O'LEARY,
Secretary of Energy,
Washington, DC.

DEAR SECRETARY O'LEARY: The Defense Nuclear Facilities Safety Board (Board) has reviewed the report prepared by the Energy Advisory Board's Task Force on "Alternative Futures for the Department of Energy National Laboratories." The Board provided the Task Force Chairman a number of comments by letter dated February 22, 1995, a copy of which is enclosed. You may wish to consider the Board's reaction to the report as you and your staff deliberate upon the Task Force's recommendations. The Board will be particularly interested in those actions the Department may initiate that affects the health and safety management programs of the weapons laboratories and associated cleanup programs.

Sincerely,

JOHN T. CONWAY,
Chairman.

DEFENSE NUCLEAR FACILITIES SAFETY BOARD,
625 Indiana Avenue, NW, Suite 700,
Washington, DC, February 22, 1995.

Mr. ROBERT GALVIN,
Chairman, Secretary of Energy Advisory Board Task Force,
Department of Energy,
Washington, DC.

DEAR MR. GALVIN: This letter is in response to a general invitation for comments on the report "Alternative Futures for the Department of Energy National Laboratories" which was issued on February 1, 1995 by the Task Force which you chaired.

As you may know the Defense Nuclear Facilities Safety Board (Board) was established by Congress in 1988 to provide independent, external oversight of public health and safety of the Department of Energy's defense nuclear complex. More specifically, the Board was directed by Congress to "recommend to the Secretary of Energy those specific measures that should be adopted to ensure that public health and safety are adequately protected." This action was precipitated by a Congressional perception that there was a need, short of formal regulation, for assuring the public that the operation of the nuclear weapons complex was proceeding safely and according to safety practices at least comparable with those in use in the commercial nuclear industry.

Although the experiences and views of the Defense Nuclear Facilities Safety Board were not sought by the Task Force in the preparation of its report, the Defense Nuclear Facilities Safety Board was represented at your summary presentation to the Energy Advisory Board on February 1, 1995. Board members have since had the opportunity to read the Task Force report in detail.

While the Board focused its review primarily on those portions of the report dealing with the weapons laboratories and the legacy of the weapons production program now subject to massive clean-up efforts, the Board notes that some issues relate to many other DOE activities as well.

The Board commends the Task Force for its insightful characterization of the present state of the national laboratories and its offerings of recommendations for redefining missions and revamping governance. We agree with many of the recommendations, particularly as they pertain to the defense nuclear complex, of which the weapons laboratories are a vital part. The Board through its activities during the past five years has addressed a number of the same issues your Task Force studied, and provided recommendations to the Secretary of Energy. DOE has accepted and has corrective actions underway for all Board recommendations except for the most recent, for which the Secretary has not had sufficient time to respond. The Board assumes that the Task Force has had access to all Board recommendations and the associated implementation plans.

As you may conclude from points made in comments attached to this letter, there is substantial agreement between recommendations made by the Defense Nuclear Facilities Safety Board and a number of those made by the Task Force. While finding much about the report upon which we agree, there are aspects wherein our viewpoints differ. In particular, the Board takes issue with a number of assertions relative to the Board's oversight activities.

This week the Board has completed its report to Congress on the Board's 1994 activities. As required by Congress, the Board's report this year includes an appraisal of how well the Board has done its first five years of operation in meeting Congressional objectives in establishing the Board. A copy of this report will be provided to you by separate correspondence.

As I informed you prior to and subsequent to the release of the Task Force report, the Board members were prepared to meet with you at your convenience. The Defense Nuclear Facilities Safety Board continues to stand ready to meet with you and, if you wish, discuss the comments we have made on the Task Force report or on our own 5th Annual Report to Congress.

Sincerely,

JOHN T. CONWAY,
Chairman.

Enclosures.

ENCLOSURE I

General Comments:

1. *Mission Definition:* First and foremost, the Board agrees that the primary missions of the Department of Energy are (1) national security and defense and (2) energy assurance, long term. These must be pursued while working to safely dispose of the hazardous residuals of past weapons production and to right the damage to the environment that resulted from such production.

2. *Performance Criteria vs Safety-Related Requirements:* The Board is well aware of the multiplicity of requirements and the mixture of requirements and "guidance" prescribed by DOE under a rather chaotic "Order" system. Undoubtedly great benefit would accrue from a comprehensive, systematic review and scrubbing of all these Orders, and the DOE, under Board urging, is doing just that for Orders that are nuclear safety related. There is much experience, notably in naval and commercial nuclear power programs and in many of DOE's own non-laboratory facilities that have demonstrated that a requirements-based program is both essential and effective. The alternative of using "performance criteria" as a basis for assuring worker and public health and safety seems to represent the other extreme that would replace well established good practices with expressions of goals or intentions.

The Board addressed the DOE Order system in Recommendation 90–2 *DOE High Priority Defense Nuclear Facilities; Design, Construction, Operation and Decommissioning Standards.* DOE was asked to (1) identify the applicable requirements for its various activities, (2) assess their adequacy for that activity, and (3) once identified as the appropriate set of requirements, assess their implementation. The fundamental thrust of this recommendation was that DOE should develop and implement a tailored set of applicable health and safety requirements the Department believed to be appropriate for each facility on site. The Board has advocated that this be done through establishment of both site-wide and facility-specific Requirements Identification Documents (RIDs). For a RID, DOE would evaluate not only those applicable requirements identified in DOE Orders and Rules but also in industry standards. Such documents when developed jointly by DOE and contractors would thus become a much more precisely defined set of requirements upon which a safety management program for site and/or facility could be based and acceptable safety performance could be evaluated. DOE is moving in that direction but much slower than the Board has sought.

3. *De-Federalization of the Laboratories:* Laboratories that attract the specialty skills capable of performing advanced research and developing advanced technology are a challenge for the Federal structure to manage. Even so, there are numerous examples where this has been done successfully: e.g.: Bettis and Knolls Laboratories of the naval nuclear propulsion program, Fermi Lab, Brookhaven and SLAC under management and direction of DOE. The micromanagement by DOE's national laboratories is the point at issue and surely that can be resolved short of de-Federalization. It is unrealistic in the Board's view to expect the Federal Government to provide national laboratories a form of block grant funding without some form of Federal oversight to assure accountability of expenditures and programs directed towards mission objectives. While some alternative to the current governance system may be in order, the de-Federalization concept appears too extreme, especially for weapons-related activities.

4. *Elimination of Internal Environmental, Safety & Health (ES&H) Oversight:* There appears to be the perception that eliminating internal oversight of compliance with ES&H requirements and making the laboratories subject only to external oversight by Federal, State and local regulatory authorities will somehow dramatically reduce the compliance burden. Perhaps it would, somewhat, where there is needless layering, but not to the extent envisioned by those advocating this approach. The major effort required to satisfy health and safety and environmental protection requirements—whether promulgated by DOE or an external regulator—must be expended by the line management organizations, not oversight groups. Further, if industry practice is to be the role model, internal oversight of compliance with environmental protection and health and safety requirements is standard practice, and a certain amount of it is essential for DOE to be confident in having met its responsibilities.

5. *Stabilization and Cleanup of Hazardous Material:* The Board agrees with your Task Force that the Department of Energy "faces a monumental task in dealing with the radioactive and hazardous wastes at its former nuclear weapons production sites and national laboratories," and strongly supports the call for greater use of the "expertise and untapped potential resident in the scientists and engineers at the National Laboratories, to address this task. Board Recommendation 94–1, "Improved Schedule for Remediation in the Defense Nuclear Complex," called for the establishment of a research program to address alternate processes to be used in safe conversion of various types of special nuclear materials to optimal forms for safe interim storage and longer term disposition. The potential for the national laboratories to conduct such research and development is beyond argument. The Board also believes that the existing knowledge and skill base at the laboratories could be better used today to help solve problems that exist throughout the complex. For example, the Board has strongly encouraged DOE to bring to bear the considerable expertise at Los Alamos in stabilization of plutonium residues, in solving problems at the Rocky Flats Environmental Technology Site and at the Hanford Site.

Recommendation 94–1 also stated that DOE's plan for stabilization of special nuclear material should be founded on systems engineering, drawing on the integrated use of facilities and capabilities at all of DOE's sites. As this Recommendation indicates, the Board shares the Task Force's evaluation that "a comprehensive remedy to the array of problems plaguing the EM program can only be achieved by a substantial commitment and high priority addressing the challenges of this program." We concur that substantial improvements in DOE EM's management and leadership will be required for the necessary progress to be made.

6. *Retention of Technical Expertise at Weapons Laboratories:* The Task Force report enumerates requirements for the DOE weapons laboratories' primary mission,

stockpile stewardship, which the Board also endorses in the interest of assuring public health and safety. In our Recommendation 93–6, *Maintaining Access to Nuclear Weapons Expertise in the Defense Nuclear Facilities Complex,* the Board highlighted the vital need to retain access to and document the unique capabilities of those individuals with direct, extensive experience in certain critical defense nuclear activities, in order to avoid future safety problems in these and related activities. Congress, in the National Defense Authorization Act for Fiscal Year 1995, also shared concern as to losses of personnel and skills from the defense nuclear complex. Section 3131 of the Act requires the establishment of a "Retiree Corps," to provide "appropriate assistance on nuclear weapons issues, to contribute relevant information to be archived, and to help to provide training to other scientists." It is hoped that DOE's response to the concerns voiced by Congress, by the Board, and now by your Task Force on this important matter will receive adequate resources and management attention to achieve the necessary results.

7. *Upgrading Technical Expertise:* Regarding upgrading DOE's technical expertise, the Task Force report states, "The root deficiency . . . is the absence of a sustained, high quality, scientific technical review capability at a high level within DOE as well as a lack of leadership and poor management of the science/engineering-operational interface." The Board has been stressing the point with DOE for some time. One of the primary Congressional goals for the Board is to raise the technical competence of the DOE's defense nuclear establishment. The Board has been acting to further this and hopes that through effective implementation of the Board's Recommendation 93–3, *Upgrading DOE Technical Capability,* DOE will achieve this goal.

8. *Weapons Laboratory Research Facilities:* The Task Force recommended continuing support for specific national laboratory facilities that will be essential for support of the stockpile stewardship mission. In this same vein, the Board has highlighted the need for DOE to retain its program of general purpose nuclear criticality experiments. In Recommendation 95–2 *The need for Critical Experiment Capability,* the Board recommended that this program be directed towards improving the information base underlying prediction of criticality, as well as serving to educate and maintain the critical skills of the community of criticality engineers. In response to this Board recommendation, DOE formed a Nuclear Criticality Steering committee to direct the development of an appropriate experimental program. DOE identified the Los Alamos Critical Experiments Facility (LACEF) as the defense nuclear facility to be used. The Board believes that LACEF should be included among the research facilities that merit continuing support.

9. *Safety Management in the Research Environment:* The Board has placed considerable emphasis on disciplined conduct of operations for defense nuclear-related "production" activities, wherever those activities take place. As noted in the Task Force report, the move to eliminate excess capabilities is resulting in some "production" activities being located at national laboratory facilities that for some time had been committed solely to research and development. To the extent that the weapons laboratories become "production" facilities, similar discipline would be expected. However, the Board has recognized that there can be considerable differences between the conduct of R&D activities by skilled scientists and engineers in laboratories, and "production" activities of less skilled workers. The Task Force should be aware of a review effort presently underway by the Board to determine whether there may be a more appropriate subset of requirements for the management of safety of research and development activities other than those now in DOE Orders, which are slanted more toward production and utilization facilities. This review is scheduled for completion in the spring of 1995.

ENCLOSURE II

Specific Board-Related Comments:

The material presented in appendices A & B of the Task Force report is represented as a "litany of anecdotes" illustrating excessive oversight and micromanagement. The validity of these individual assertions does not appear to have been assessed. However, their listing in this report suggests that the Task Force believes they are valid. Since the Board was the target of a number of these assertions, we feel it important to correct a number of misrepresentations.

1. Page A–5—Report Quotes:

> There is neither a mechanism within DOE to evaluate and stand against poorly-taken DNFSB edicts nor to ensure Department-wide compliance with those judged appropriate.

> One array of difficulties with which DOE has not yet been able to deal properly is ironically self-inflicted. Far too much influence has been ceded to non-regulatory boards, such as the Defense Nuclear Facilities Safety Board (DNFSB). Such organizations generate recommendations with no apparent cost/benefit analysis, resulting in significant unnecessary expenditures and productivity losses.

Commentary: First, it is important to understand that the Board's enabling legislation does not authorize the Board to "edict" anything. The Board makes recommendations to the Secretary of Energy regarding matters affecting public health and safety, which the Department can adopt wholly or in part, or reject. Moreover, under the Board's enabling legislation, the Secretary of Energy has the right to demur on a recommendation of the Board (or part thereof) based upon budgetary considerations. If a recommendation is accepted, the DOE must prepare an action plan that is responsive to the recommendation. The Board has insisted that such action plans be prepared, reviewed, and approved by senior DOE officials who have programmatic responsibility for addressing the safety issues involved. To say that DOE does not have a mechanism for review of recommendations brought to it by the DNFSB does DOE an injustice. However, if the Task Force regards this assertion as true, the Task Force should have concern about the fate of the Task Force's own recommendations which must be considered by the same senior DOE management.

2. Pages, A–1, A–2, A–7—Report Quotes:

> Hundreds of full-time equivalents are attending to issues per laboratory to see to meeting of DOE requirements that are in excess of Federal, State or local regulations and/or are in excess of requirements for a comparable commercial activity.
>
> Almost everyone must follow new rules and orders not necessarily relevant to their situation, if perchance a few erred elsewhere.
>
> Operate labs according to industry-wide regulatory standards.
>
> Replace compliance-based directives with simple, well-defined performance measures.

Commentary: The DNFSB during its 5 years of existence has, in keeping with its enabling legislation focused upon the DOE Orders, currently 58 in number, that spell out requirements bearing upon nuclear safety—the protection of workers, the public and the environment. Through a number of its recommendations, the Board has urged the Department to examine the sufficiency and applicability of requirements in these orders, to upgrade those needed and eliminate the superfluous. More importantly, the Board recognized that requirements in Orders had to be fitted to the specific facilities and sites and urged the Department to develop site and facility-specific Requirement Identification Documents (RIDs). The DOE has committed to proceed accordingly. While the weapons laboratories have had the opportunity to help define the safety related requirements that are applicable to their activities they have not expeditiously moved to do so.

The Board in its review of requirements set forth in DOE's safety related Orders (and more recently Rules) has always used industry-wide regulatory standards as a frame of reference. The Board's reasons for doing so are two fold: (1) The collective experience of the Board and its staff is that compliance with such standards is essential for ensuring protection of public health and safety. (2) Congress has stated its expectation that the Board endeavor to bring nuclear safety at defense nuclear facilities up to the level of the commercial nuclear industry. In general, the Board has found DOE nuclear safety requirements reasonably consistent with comparable requirements used to regulate the commercial nuclear industry. The Board would be pleased to see the laboratories operate to such standards. The problem is that they historically have viewed such requirements as undue restraints. The record is replete with examples where safety practices at the weapons laboratories do not meet commercial industry standards.

Performance measures are useful management tools but are no substitute for the system of requirements and safety practices that have been developed and implemented over the years to assure worker and public health and safety. Performance measures are really only methods for grading the success achieved in conforming to established standards.

The Board is responsible for the current independent Federal oversight of nuclear safety practices at the weapons laboratories. This arrangement provides external health and safety oversight, using standards comparable to those used by the commercial industry, without the added complexities of a more formal and structured regulatory program.

3. Page 53—Report Quote:

> One array of difficulties with which DOE has not yet been able to deal properly is ironically self-inflicted. Far too much influence has been ceded to non-regulatory advisory boards, such as the Defense Nuclear Facilities Safety Board. Such organizations generate recommendations with no apparent cost/benefit analysis, resulting in significant unnecessary expenditures and productivity losses.

Commentary: The Board, although not strictly a regulatory body as noted in the Task Force report, was established by Congress in 1988 as an independent agency in the executive branch with certain statutory authorities and responsibilities (see 42 U.S.C. § 2286 et seq.). The Board was directed by Congress to "recommend to the Secretary of Energy those specific measures that should be adopted to ensure that public health and safety are adequately protected." (ID. § 2286a.) Therefore, it is not accurate to characterize the Board's influence as having been "ceded" by DOE.

The consideration of "economic feasibility" of Board recommendations as required by its enabling legislation does not necessarily require detailed cost/benefit analysis. While the Board has not felt the need to date to so justify recommendations to bring nuclear safety practices at defense nuclear facilities in line with commercial practices, the Board has been mindful of the economic implications of its recommendations. The Board has recognized for example, the graded approach that DOE has advocated in safety upgrades to the aged defense nuclear complex. Moreover, the Secretary may reject recommendations wholly, or in part based upon budgetary considerations.

The requirement laid on all users of nuclear materials under the Atomic Energy Act to provide for protection of workers and the public is applicable to the national laboratories as well as the commercial sector. The argument that assurance of safety results in "unnecessary expenditure and productivity losses" is in principle untenable. The pain that the laboratories are experiencing to upgrade environmental, health and safety programs is largely the result of past patterns of behavior your report describes on page 27.

Senator KEMPTHORNE. Mr. Conway, first of all, thank you again. You are a very effective spokesman for the Board, and we appreciate that the entire Board is here. Do you know whether the Department of Energy has implemented your Board recommendation to use recently retired weapons' experts?

Mr. CONWAY. Not as effectively as we would like to see it implemented. I was told at one point that personnel who took the buyout—have taken early retirement getting $25,000 or whatever it is—could not come back and work for the U.S. Government. However, it is my understanding that this requirement can be waived, and we have been pushing the Department of Energy on those critical numbers of the laboratory personnel, that they utilize that capability for those particular areas, that they have their expertise.

Senator KEMPTHORNE. That would be a tremendous resource, would it not?

Mr. CONWAY. It is excellent. In fact, I would compliment the Senate Armed Services Committee. In your authorization bill last year, you had foresight enough even to set up a reserve group. I can certainly say that is the group you put in a reserve unit, like the Army. If you retire from the Army or the Navy, Senator Glenn would know this, once you retire you will still be able to be called back at anytime. I suggest that is what the situation should be with the laboratory personnel with weapons design experience, that they be in a reserve and be called up as we need them.

Senator KEMPTHORNE. Now, Mr. Conway, where will we get the next generation of those kinds of experts? Because it is my understanding, as I talk to different labs, those individuals are weeding out because they see no future.

Mr. CONWAY. Well, that is very important. That is why when I remember back, there was a 3-year moratorium on testing some years ago. Back in even the 1960s we were concerned—Dr. Teller was concerned, others at Los Alamos, Dr. Bradbury—that we were not able to bring in young scientists from universities.

If you make the work interesting enough, if you give them the proper mentors who will take an interest in these young scientists coming out of the universities, it can be done. We have done it over the years, the 1940s, the 1950s, the 1960s, the 1970s, and the 1980s, it can be done. We do not need a large number of them. We need a smaller group of dedicated conscientious individuals who are willing to do that.

Senator KEMPTHORNE. Is it accurate to say, though, that those mentors that you are referencing are a dwindling group?

Mr. CONWAY. It definitely is. It is a dwindling group. Unless we can tap that capability now, it will disappear on us.

Senator KEMPTHORNE. Also, I am going to note that you are one of those increasingly rare individuals that has that background of expertise with broad experience in this area.

Mr. CONWAY. I would include the other members on this Board. I am the second youngest on the board. [Laughter.]

Senator KEMPTHORNE. I will respect that. Can you comment beyond the scope of your present responsibilities with the Defense Nuclear Facilities Safety Board, and suggest a top level integrated approach for making the Department of Energy EM program more practical and affordable? How can you make this program effective in doing real cleanup and real environmental remediation and health protection? In very straightforward terms.

Mr. CONWAY. It seems to me it has to be a systems approach. We have to take a look at each and every one of the sites and set priorities. I start first with the priority of the current danger, and that is the stability of some of the material that is out there. This is something one of our recommendations addresses, 94–1, that the Department of Energy determine at each of its locations what is the most dangerous materials right now that we have to stabilize.

Then we have to, it seems to me, set a priority as to at each site where we now are going to work through a systems approach of what we would do in a normal priority where you would clean up. Then each site having done that, there has to be some way that headquarters can look at each of the various sites and then set priorities among the sites. But that has to be done by people who are technically competent to do this. It has to be done in such a way that no matter what the political flack may be, that it has to be approached from that point of view.

Senator KEMPTHORNE. Now, is that being done? What is the statute recommending that that is the direction we need to go in?

Mr. CONWAY. The answer is, no, it is not being done properly as of now. We are still in the stage of trying to set priorities from the point of individual sites and particularly with regard to priorities of their most dangerous materials and situations out there now.

Senator KEMPTHORNE. But your Board could accomplish that?

Mr. CONWAY. We will be in those areas that we are responsible for, and that is in the defense facilities. We have no responsibility by law in those areas that do not fall within the defense facility.

Senator KEMPTHORNE. We have spoken, too, just a moment ago. But before I get to that, any other suggestions or recommendations?

Mr. CONWAY. Well, I guess I think the other recommendation would be that the Department of Energy implement the existing 31 recommendations which they have not completed as yet. They have completed implementation of—the last count ı saw was 11. We have 20 recommendations outstanding now at various stages of implementation. This is a responsibility of this Board to follow those implementations.

Senator KEMPTHORNE. How would you characterize the Department of Energy's response to those recommendations? Are they taking them seriously, do you think there is a good faith effort, or are they defensive about it?

Mr. CONWAY. Well, it depends on who you are talking to. I think each and every recommendation we made to date has been accepted by the Secretaries that we have served. By "served" I mean making recommendations, one was an Acting Secretary, Admiral Watkins initially, and Hazel O'Leary have accepted each and every one of our recommendations.

The problem then comes usually in the implementation of recommendations. We find several implementation plans have been received very promptly from the Department of Energy and we move ahead on, and they tend to be the ones that the Department of Energy itself wants to do. On others, we find there is some reluctance as you go down the line. Part of the problem, I believe, one of the major problems is the lack of technical competence by personnel in the Department of Energy to understand how to implement it properly. This takes a great deal of our time, the Board members as well as our technical staff.

Senator KEMPTHORNE. I appreciate that. I want to turn to Senator Glenn now for his questions, but may I make a request of you.

Mr. CONWAY. Yes, sir.

Senator KEMPTHORNE. That is, would you write me a letter explaining how the EM funding is related to the health and safety issues that the Board has identified? We can use that in our efforts to try to get appropriate funding for this whole project. With the perspective of your Board, that would be a helpful tool.

Mr. CONWAY. My pleasure.

Senator KEMPTHORNE. Thank you. Senator Glenn.

Senator GLENN. I would like to follow up on the chairman's questioning here. John, from your written testimony, you have made 31 sets of recommendations to the Department of Energy, 139 specifics. Now, you indicated just a moment ago that they had accepted all of these.

Mr. CONWAY. That is correct.

Senator GLENN. Now, is the reason they are not completely taken care of a matter of will or is a matter of dollars?

Mr. CONWAY. I have seen no indication it is a question of dollars. Similar to what Tom Grumbly said, at times someone claims they will take an exorbitant amount of money to do something. When you look into it, it is sometimes more often than not used as an excuse not to do something, or because they do not know how to do it.

To the best of my knowledge, I have not had any indication where the Secretary or the Department of Energy has come back and having accepted our recommendation, then said, "oh-oh, we can't do it." In fact, the law as written by the members of this committee and as it exists in the law today, if and when it becomes a problem of funding, there is a requirement that the Department of Energy through the Secretary notify Congress and notify others, including the President, as I recall, why the Department of Energy cannot complete a recommendation.

Senator GLENN. Are they required now to do that?

Mr. CONWAY. Yes, sir, under the law. Having accepted the recommendation, if thereafter they find budgetary constraints make it impossible to do so, there is a requirement in the law that before they then start to refuse to or not implement the recommendation, they must send a written communication to Congress to that effect.

Senator GLENN. Have we received any of those, do you know, Mr. Chairman?

Mr. CONWAY. There has been no such notification ever given to Congress or to us, "us" being the Board.

Senator GLENN. Well, I just want us to follow up on this.

Senator KEMPTHORNE. I agree.

Mr. CONWAY. If I may stop, Senator Glenn, in the act it says as follows: "If the Secretary of Energy determines that the implementation of the Board recommendation or a part of thereof is impractical because of budgetary considerations, and there are other exceptions, the Secretary shall submit to the President, to the Committees on Armed Services and on Appropriations of the Senate, and the Speaker of the House of Representatives a report containing the recommendation and the Secretary's determination."

Senator GLENN. Yes, I am recalling some of that now. [Laughter.]

Senator KEMPTHORNE. I think you had a hand in putting it in there.

Senator GLENN. The committee made some changes and changed it around.

Mr. CONWAY. Yes, sir.

Senator GLENN. But I do remember that thing. We put some teeth into what you were going to do. We put in a requirement that there be some followup.

Mr. CONWAY. You also put a requirement in that if an implementation plan, a recommendation, cannot be implemented within a year, the Department of Energy was required to submit such a notification to Congress and the reason thereof. Now, many of the recommendations basically cannot be done within a year, but that still requires a notification by the Department of Energy to Congress of that effect.

Senator GLENN. Since I found out about my involvement— [Laughter.]

Senator KEMPTHORNE. It is duly noted. If I might make a comment, not charged to your time, but what strikes me it should not be a system where it is easier to say, "well, gentlemen, thank for your good effort. We accept your recommendations," knowing full well they will never be implemented, because that is just easier, and we stick them on a shelf.

Mr. CONWAY. Well, they have to come back with an implementation plan within 90 days by law. If they cannot make it within 90 days, they are given another 45 days. Unfortunately, on some occasions initially there is a tendency when they get a recommendation and when the Secretary accepts it, and then it gets sent over and they think, "oh, well, we have 90 days, maybe another 45, we will get around to that."

Then someone gets the responsibility of drafting up the implementation plan. Unfortunately, on too many occasions there has been someone fairly low down in the Department of Energy organization that cannot carry it through. We have offered the assistance of our technical staff and the Board members. As soon as the recommendation goes over and the Secretary accepts it, we then offer our technical staff and ourselves to help draft up the implementation plan to assure that the objective that we are trying to achieve is met.

We have, for example, plans that come back, implementation plans, that do not meet the objectives, so we have had to return them, back and forth sometimes. We will work with them right from the very beginning. We look upon that as something of a responsibility.

Senator KEMPTHORNE. I think it is a good area that you have identified that we now, as a committee, need to pursue.

Senator GLENN. Yes, and I do recall your making a little joke about it. I do remember we wanted this to be just what you said. We wanted it to be just recommendations. We wanted to follow up on this thing, so that they had to answer what the recommendation was. We wanted to give you that kind of teeth.

Mr. CONWAY. Yes, sir.

Senator KEMPTHORNE. Now, the Secretary has formed this External Nuclear Safety Committee, and John Ahearne, I think, is chairing that. They are going to make their recommendation sometime later this year, I guess. How does that conflict with you, or how do you see that affecting the reauthorization of this group?

Mr. CONWAY. Well, in our 5-year report which we were required to submit to this committee in February, we made our recommendations. We do not believe external health and safety oversight should go under regulation, under licensing, in the true sense of regulation. The Ahearne Committee, as I understand, will make their report or recommendation sometime later this year. The Board received a communication from the White House and also a request from Hazel O'Leary, asking us to have representation on the Ahearne Committee. Mr. Joseph DiNunno, a member of the Board, has been kind enough to accept that responsibility and he is serving on the Ahearne Committee. He is a member of the Ahearne Group, representing the Board on that study.

Senator GLENN. Well, I think we need to as a committee look into this very carefully. I favor extending your Board.

Mr. CONWAY. Thank you, Senator.

Senator GLENN. But I think we have to look at what she is doing and whether there is some advantage or what. I do not know whether the two Boards are duplicative. We do not just want to duplicate, duplicate. On the other hand, if you are doing a good job here, do we need the other one? Do we need this other group continued? Or, does it make recommendations of some kind to her and then phase out and you continue?

Mr. CONWAY. Well, my understanding is the Ahearne Committee has been formed for a specific purpose: that is, to make a recommendation. It does not continue thereafter. It is a committee that can only make recommendations after reviewing all of the facts.

Senator GLENN. Mr. Chairman, before my time is up, I might say do any of his Board members have a statement or is there any comment they wish to make either in support of or critical of the chairman, either one?

Mr. CRAWFORD. I do, John.

Mr. CONWAY. Captain Jack Crawford.

Mr. CRAWFORD. The question was asked as to why the difficulty is being encountered in carrying out the implementation plans? It is my personal view, based on almost 6 years of service on this Board, that the problem relates not so much to will—although, it does in some cases—as to the lack of sufficient numbers of appropriately qualified people from a technical point of view.

Now, there is a long story associated with this lack. There are at least six independent studies that have been made, two of them by the National Academy of Sciences, which point out to this lack of technical capability on the staff of the Department of Energy. The Board itself has said each year of the 5 in which it has submitted an analysis, that the principal problem affecting safety in the Department of Energy, as it pertains to defense-related nuclear facilities, is the lack of sufficient numbers of people who are qualified technically.

I would like to endorse the Chairman's statement that the problem is one more of technical capability than it is of will. Until that problem is corrected, and it does not take large numbers, but until full use of this excepted service authority is used, the Department of Energy will never correct the problems they currently have.

Senator GLENN. My time is up. Do we have adequate numbers of people to do this? Are there adequate numbers of people who have that kind of experience in this country, or do we need to train some people?

Mr. CONWAY. We need to train them and develop them, and there are people out there. This Board we have today, the last time I counted I had 63 technically competent persons working, both men and women, for the Board. We were very selective. We had at least 5,000 applications for jobs. None of the technical personnel has come to work for us without being interviewed by each and every one of the members here. The Board members interview each one of them.

There are personnel capable of doing this work out there, well trained, with Ph.D.s, masters degrees. We are also running an intern program. We are getting very bright, young engineers and physicists from colleges and getting them mentored. They are out there, but somebody, personnel in the Department of Energy has to put attention on this, and make somebody responsible for getting these people.

With many corporations closing down or cutting back significantly, the jobs are not that many out there today, as young people are coming out of college or experienced personnel. We have a number of Ph.D.s that are very competent that we were able to hire. They are there.

Senator GLENN. How about the Navy nuclear program?

Mr. CONWAY. We have quite a few Navy nuclear people who are well trained in the reactors. We took a number of them, and when this committee in 1991 gave us the added responsibility of safety of the disassembled weapons, we selected some of these people and we sent them to special schools. We sent them to Sandia. They had a good technical background already, although they did not know the weapons themselves, but by being trained down at Sandia it helped.

We brought on some experts, for example, Harold Agnew is a consultant, who was former head of Los Alamos; Dr. Jack Howard, also with Sandia, Executive Vice-President from Sandia. They have been mentoring our people. We have some other experts out of Livermore. Dr. Jerry Tape, well known throughout the history of weapons, and he is a consultant. They are acting as mentors for our people.

Senator GLENN. Well, my time is more than up, Mr. Chairman. Thank you for extending me on that. I just want to thank you and the members of the Board for what you are doing here. I think it is invaluable that we have this kind of safety input for our nuclear program. You people can look where you want to look. You have full authority to go where you want to go and look at what you want to look at. I think you perform an invaluable role in making sure that we have not had Chernobyls and all of the other things.

Mr. CONWAY. Well, as we studied the law that was passed, which is our bible, we looked to see if we could make any recommendations to strengthen our hand. We think this committee, and you specifically, made some very strong positions available to us, including you gave us subpoena power. If need be, we can hold hearings. We have been learning ourselves how best to use some of the power that you gave us.

Senator GLENN. Thank you for your efforts.

Mr. CONWAY. Thank you, Senator Glenn.

Senator KEMPTHORNE. Mr. Conway, should the Department of Energy and the national labs be required perhaps to start a Defense Fellowship Program for graduate or undergraduate students?

Mr. CONWAY. I would certainly encourage that.

Senator KEMPTHORNE. Could you give me, Mr. Conway, a sense of the health and safety concerns at the Hanford site, and what recommendations has your Board made regarding Hanford?

Mr. CONWAY. We made a number of specific recommendations as pertains to Hanford. Number one, we selected a number of the facilities at that site which we considered areas that must be attended to in a very short time period. We have been very unhappy with the characterization program of the tanks. In fact, about 4 weeks ago we held a hearing out at Hanford specifically on the characterization problem.

We do not believe that the 177 tanks should exist out there in the condition they are now. We do not know the composition of the material in most of those tanks. We are not satisfied with the way in which samples are being taken and being analyzed.

The new head of Westinghouse, head of that program, wrote a letter to the Board. I received it yesterday, in which he said he is now making a nationwide study, looking for someone to take over the tank program out there. He himself has acknowledged that it has not been very well done.

One of my Board members has also brought it to my attention the K-East Basin. That has been one of the areas we have been most concerned about, the K-East Basin. That is close to the Columbia River, fuel elements have been sitting and deteriorating, and will continue to deteriorate with potential leaks into the Columbia River.

Now, here is an example where an existing law was used as an excuse not to do work that was necessary. When we first asked why is not some work being done to encapsulate these fuel elements that are deteriorating and clean up that K-East Basin we were told, "well, we cannot do that. Because if we try to do that work we are going to release some materials into the atmosphere, and we will be in violation of the Clean Air Act."

That was being used as an excuse, in our opinion. By sitting down with EPA personnel and State personnel, we were able to explain that the danger of that material continuing to deteriorate was much greater actually than the amount of material that might move into the atmosphere. You are going to find other areas along that line.

Some action where they go in to clean up an area, a hazardous area, may be a technical violation of the Clean Air Act or possibly the Clean Water Act. We are going to have to face that, and then judge the relative hazards and make decisions.

People who are technically competent have to get their facts together. When you bring that to the public's attention, particularly when you bring it to the State personnel, it has been our experience they understand that and they will cooperate.

Senator KEMPTHORNE. Would you also, then, characterize the most critical health and safety concerns the Board has identified at the Idaho National Laboratory?

Mr. CONWAY. Okay. Well, at Idaho they also have some problems, obviously fuel elements are deteriorating in the 603 Basin that need to be attended to, similar to the problems that they have at the K-East Basin, very definitely. Also, they have had problems out there making sure that we train personnel. They have had troubles in picking people. It is important that new people who come in have to be trained and understand the job they are going to have to do.

This is a continuous job that constantly has to be attended to: enhanced worker safety at the high level waste tank farm, do an improved work plan, and improve contamination control. That is one of our concerns right now. Significant improvement in safety and spent fuel movement from old degraded fuel basins into newer fuel basins, moving into that 666 Basin. Improve contractor and Department of Energy readiness evaluation to start up a facility that processes high level liquid waste into stable, solid form for storage, and improve operating procedures and better worker knowledge, use of procedures at the Calcine Facility. Somehow or other one of my Board members thought you might have a question about that.

Senator KEMPTHORNE. Very perceptive. [Laughter.]

Senator Glenn made a point that we certainly have not experienced a Chernobyl, and we really have an outstanding safety record. Overall, what is your perspective on the health and safety of this nuclear material that is stored that if the public knew of it would certainly become a higher priority to deal with?

Mr. CONWAY. I would say the defense facilities where they are located have a tremendous amount of land around them, unlike a reactor that has smaller buffer zone, if you will. The dangers are not so much to the public. The dangers are to the workers in the site. There are hundreds of facilities at each one of these sites. If a worker at one of the various facilities within the site had a bad accident, it could have a profound effect on other workers. As we do our work, we treat the worker as a member of the public.

That worker who may not be at a particular facility where the accident would occur, but is working in and around that area, other facilities, we treat that individual as a member of the public. There are dangers there to the worker. I point out continuously that as we go in and try to clean up some of these facilities, they are going to be very difficult jobs to do, some places are going to have to be entombed the way they are; we are not going to be able to clean them up.

As the workers go in and try to do some of this work, I expect the so-called "man rem" to go up at a particular site. If you are not doing any work, and that was one of our problems, in my opinion, at Hanford, that we were not going in and cleaning up the K-East Basin we were not getting the samples from the tanks, so the man rem was pretty low.

If you judge a contractor on the basis of, "well, you have a low man rem," maybe it is because he is not doing any work. When they get in to really do some of this dirty, tough work, we are going to see the total man rem go up. We have to understand that. We should not penalize on that basis alone a contractor who may be getting in and trying to do the work.

Senator GLENN. We want to keep the same level?

Mr. CONWAY. You want to try to keep it as low as you possibly can, allowable. You do not want to exceed what is allowable. The key thing is, and we have to follow this concept, you do not try to get everyone up to the amount that he or she may be permitted. You try to keep it as low as needs to be achievable. That has been a method of judging, if you will, some of our contractors and some of our field officers. It will be going up as we do this work, but we should not exceed what the regulations stipulate.

Senator KEMPTHORNE. I have just a few more questions.

Mr. CONWAY. Yes, sir?

Senator KEMPTHORNE. Senator Glenn, do you have any more questions you would like to ask?

Senator GLENN. Your comments on privatizing, you mentioned that a little bit earlier. What is your thought on that?

Mr. CONWAY. Well, I will be frank with you. I do not understand what they mean by "privatizing." I listened to Mr. Galvin here and I do not know what he meant between—what did he call it?—

"corporatizing" and corporate. I would have to have it more clearly explained to me what he means.

If we are talking about bringing in private corporations that will take the risk—now, I sat on boards of directors, and I do not know any board of directors willing to take their corporation and let their Chief Executive Officer take on a risk, a financial risk, that he does not first take a look at.

What we are seeing is new corporations being formed. We are not going to see a Westinghouse or a GE or any of the other major corporations putting the parent corporation to risk. They will set up new corporations as they are doing right now at Rocky Flats.

Some corporation will be set up—I do not want to use the pejorative term of shell corporation, but it will not include the risk of the parent corporation. Now, if they say it will be run like a corporation, they will not be paid until they do certain work. Now, how do you meet your payroll?

You have a contract that guarantees you or does not guarantee you a certain amount of money. If you are not guaranteed the money until you perform, to pay your payroll you are going to have to go to some bank and say, "here, here is my collateral, give me a loan, or I will get some equity, or sell bonds." I do not know. But they are going to have to have some way to fund that corporation. Maybe a parent corporation will put some seed money in. I do not know. But I do not understand what they mean when they say privatize.

Senator GLENN. I am glad to know somebody else is skeptical besides me.

Mr. CONWAY. Whether you call it "corporatization" or "privatization," it has to be spelled out for me. When they talk about privatization, I think of the big corporations. Some of the big corporations, and we will not give the names of them, but Rocky Flats and some other places have some of the biggest corporations involved with those things, and they wind up in the biggest messes of anybody in the whole complex.

Now we say we are going to privatize? Are we going back to these same people that got us into such trouble to begin with and say, "okay, you now have a contract to undo what you did over all these previous years"? I do not think that is realistic. If they want to set up a private corporation, a new something or other with people like yourself on it, that is different.

Mr. CONWAY. The Department of Energy has to be specific as to what it wants a corporation, or whoever is going to do the job, to do. I do not know about this corporation that has been set up—or at least has won the contract for Rocky Flats. They, I am told, are going to integrate. I said, "what do you mean 'integrate?'" Well, this corporation now that has been formed is going to be an integrator; it is not going to do the work. I have one more layer, it seems to me.

Now, we have an integrator that is going to have other corporations subcontracted to it. Well, if EM is going to try to hire more people to do the work, why do you need an integrator to do it? I do not understand. It is outside my area, except for the safety. We will be looking at it from the safety point of view.

We have insisted that the corporation responsible for doing the work out there at Rocky Flats understands what recommendations we have made specifically with regard to Rocky Flats, and that the contract is going to require the corporation to meet the recommendations that the Department of Energy has accepted for Rock Flats.

Senator GLENN. We will ask some more questions and see what they mean exactly by "privatizing." There will be some additional questions. If you get the word on what they mean on "privatizing," let me know.

Mr. CONWAY. Yes, Senator.

Senator GLENN. Thank you for your work, gentlemen. Thank you, Mr. Chairman.

Senator KEMPTHORNE. Thank you, Senator. I appreciate your participation. Mr. Conway, I know that you are not responsible for nuclear weapon safety. However, last year Secretary O'Leary did not accept the recommendations of her technical experts, the weapons lab directors, to continue underground testing to maintain the long-term weapon reliability. My question is, are you aware of any scientific or technical basis for the Secretary's decision to overrule her experts? Is this a prudent decision, a safe decision? It is my understanding that this may be the first time in the 50-year history of the Nuclear Weapons program that has happened.

Mr. CONWAY. Let me say that it is not the first time that we have gone into a "moratorium." We had a moratorium in which we and the Russians had a standoff for a while and neither one of us tested. During the Eisenhower administration, as I recall, because I was intimately involved with it at the time Eisenhower did announce that he reserved the right to start up at anytime, henceforth.

However, it was the Soviets that were the first ones to break the moratorium. They went with, as I recall, the largest nuclear weapon test shot ever undertaken by anyone—in the megaton range—that very first one after that so-called "moratorium." My recollection is, and it has been so long I would have to go back and check, it was somewhere on the order of 3 years, as I remember, that we did not do any testing.

In any event, our Board by law has no responsibility in the design of weapons. However, one of the responsibilities we look upon is to continue to follow the stewardship program in the weapons field and also the surveillance. We are watching surveillance work that is done at Pantex. That is where over the years work will continue into the future.

They statistically will select a weapon from stockpile, bring it back to Pantex, and then look to particular components to see if reliability and safety are still being maintained. Then the particular component, whether it be out at Sandia or some other manufacturer, will be analyzed.

They will analyze it very carefully to ensure and try to get some data from it. Now, obviously that is getting individual components. That will continue and we will watch very carefully to assure ourselves, depending on how long this moratorium lasts, to make sure that that is being carefully done.

Senator KEMPTHORNE. Does that concern you, though, that we are not testing? It is my understanding that they are trying to develop computer modeling to determine the stability of the weapon stockpile. Yet, by the time they might perfect the computer modeling we have utilized half of the shelf life of these weapons.

Mr. CONWAY. As I say we have brought aboard as consultants to us a number of weapon design individuals who have been intimately involved with the design of weapons and the testing of weapons. From their information, it is our understanding that you cannot completely rely on these weapons and continue to have a great assurance in all areas of their reliability over the years and their safety.

This will require very careful analyses as we continue to go along with these weapons on the shelf. On the other hand, we have had some weapons that we have had that went back to, what, 20 or so years. The longer we go without actually testing, the more questions, I guess, in someone's mind as to their reliability and also as to their safety. But that will require good people watching it very carefully and good minds working on it.

Senator KEMPTHORNE. Do we couple that scenario with the fact that those weapons experts are retiring, and the next generation is not being brought along?

Mr. CONWAY. That is correct, and that is why it is essential that we bring new individuals into the program and document the experience of those who have been involved in the testing in the past. That is one of the areas we have looked into down at the Nevada Test Site. There is a different group of people who tend to do the testing work at Nevada as opposed to the theoreticians and the designers. We have been pushing to make sure those individuals involved with the testing and safety of the test that their knowledge will be documented also before we lose those people. They are moving out fast.

Senator KEMPTHORNE. Yes. Well, Mr. Conway, I appreciate greatly your dedication and your service and expertise that you and all members of the Board have given to this country. I appreciate your input this afternoon. It helps us with this whole situation. I am troubled as I read in the papers about in the sea of Japan the Russians are storing their spent fuel rods in old submarines. The question of security. Simply, padlocks are keeping some of this weapons material that Third World countries and terrorists would love to have their hands on, which threatens the safety of the whole world. As we continue to bring it to light, hopefully we will develop and assert the political will in solving this problem.

Mr. CONWAY. Well, thank you for your support of our Board. I appreciate it very much. We are always as close to you as your telephone.

Senator KEMPTHORNE. I appreciate that very much. Thank you all. This hearing is adjourned.

[Questions for the record with answers supplied follow:]

QUESTIONS SUBMITTED BY SENATOR CARL LEVIN

Senator LEVIN. Mr. Grumbly, while Environmental Management funding for core cleanup would actually decline in fiscal year 1996 under your budget request, the Department of Energy is proposing a $300 million increase in Defense Programs spending in fiscal year 1996, including new spending on a new tritium source and the National Ignition Facility. What will be the total project cost for those two projects?

Mr. GRUMBLY. The total project cost for the National Ignition Facility is $1,073.6 million, which includes a total estimated cost of $842.6 million and other projects costs of $231.0 million. The Conceptual Design for this facility was completed and a report was issued in May 1994. An Independent Cost Estimate was performed and it validated the total project cost amount for the National Ignition Facility.

A total project cost for the new tritium source is unavailable at this time since the Department has not yet completed the cost, schedule, and technical analyses which are necessary to fully compare the technology candidates being considered.

Senator LEVIN. What is the 5-year spending plan for Defense Programs for the next 5 fiscal years?

Mr. GRUMBLY. Defense Programs planned spending is summarized in the table below. The fiscal year 1996 level reflects a $50 million reduction attributable to the Secretary's Strategic Alignment announced on May 3, 1995. The spending levels for fiscal years 1997–2000 are contained in the National Security Programs Five-Year Budget Plan Fiscal Years 1996–2000, which the Secretary of Energy forwarded to Congress on March 20, 1995. However, as indicated in the National Security Programs Five-Year Budget Plan Fiscal Years 1996–2000, an unallocated reduction to the Atomic Energy Defense Activities appropriation exists. This reduction, entitled "Vision of Change for America," represents the administration's support for lowering the cost of government and Reinventing the Department of Energy initiatives. It is planned that policy and program decisions to distribute the "Vision of Change for America" funding reductions will take place during the fiscal year 1997 budget formulation process. The information follows:

Defense Programs Total Obligational Authority

Fiscal year:	*Millions*
1996	$3,571
1997	3,902
1998	4,014
1999	4,143
2000	4,052

Senator LEVIN. In your plans, will the Environmental Management budget be paying for managing any weapons-related work at any of the former production sites such as Savannah River?

Mr. GRUMBLY. In January 1995 Defense Programs (DP) transferred the production reactors, separation canyons and landlord functions at Savannah River from Defense Programs to Environmental Management (EM). Other facilities at the Mound and Pinellas sites are also being transferred to EM from DP. With the exception of the K-Reactor at the Savannah River Site, Defense Programs has decided that these facilities would no longer be needed to meet future defense missions. The future of the K-Reactor is discussed in detail in the response to the next question. Any and all future defense mission related activities, including, for example, possible tritium supply and recycling operations, remain in the Defense Program account.

For the facilities and materials that transferred from DP to EM responsibility, EM will provide surveillance and maintenance required to maintain the safety envelope, possible stabilization of material in the canyons, deactivation of facilities, and provide landlord functions (site infrastructure and program support).

Senator LEVIN. For instance, will EM be paying for K-reactor "standby" costs? If so, how much?

Mr. GRUMBLY. In January 1995, Defense Programs transferred the K-Reactor to EM as part of the larger transfer of facilities at the site to EM. At the time of transfer, DP had not yet made a decision as to whether this reactor was surplus to its mission. The K-Reactor has been identified as a contingency tritium production capability if it becomes necessary. The understanding at the time of transfer was that if the K-Reactor is needed for defense purposes the reactor would transfer back to DP.

Pursuant to Department of Energy national security policy, EM is maintaining the K-Reactor in a status known as "cold standby." This differs from the status ("cold shutdown") of the other former production reactors at SRS (L, P, C, and R) because it requires that fresh fuel be stored at K-Reactor. Because this fuel contains high enriched (weapons usable) uranium and it has not been irradiated, it is not "self protecting" (i.e., does not emit intense radiation, which would thwart would-be thieves), and therefore, requires a very high level of physical protection, in addition to normal industrial security.

The total cost for maintaining the K-Reactor in this status is $44 million annually, which is about $30 million greater than the average annual maintenance cost for the other reactors that are in cold shutdown. This difference is attributable to such things as the additional security, heavy water storage, and the fact that K-Reactor funding includes most personnel not assignable to another specific reactor.

The K-Reactor is not being maintained for immediate startup. Currently, EM is paying for minimum surveillance and maintenance costs, which are not adequate to prevent the condition of the reactor from deteriorating over time. If startup should be required, the necessary repairs and upgrades will be paid for by DP, not EM.

In addition to the fresh fuel, which is maintained at K-Reactor as part of the cold standby requirement, spent fuel and irradiated tritium targets are also being stored at K-Reactor. The tritium targets will eventually be transferred to the H-Area for tritium recovery. Because the targets are integral to, i.e., are part of, the spent fuel, there are no additional costs for storing the tritium targets in addition to the spent fuel, which would be borne by EM whether or not target material was attached to it.

Senator LEVIN. Will EM be paying for the separation of any plutonium at the F-Canyon that will be later used for making nuclear weapons or for hydrodynamic or hydronuclear weapons tests? How much will this activity cost?

Mr. GRUMBLY. The Department's ongoing and potential future separation of plutonium at the Savannah River Site (SRS) is being funded through the EM budget (Defense Environmental Restoration and Waste Management account), as part of the responsibilities of EM's Office of Nuclear Materials and Facilities Stabilization. The Office of Defense Programs transferred the costs for maintaining and, as necessary, operating the chemical separation canyons (known as the "F" and "H" Canyons) at the SRS to the Office of Environmental Management in January 1995.

The Department is currently processing plutonium-239 and plutonium-238 at the SRS. In accordance with the National Environmental Policy Act (NEPA) process, the Department of Energy is considering processing of additional materials. The proposed processing would solidify, and in some cases separate, plutonium-239, plutonium-242, highly enriched uranium and other nuclear materials. Except for plutonium-238, these actions and proposals to process these materials are based on considerations of safety, health, and cost, not on the potential future use of the material.

Many nuclear materials at the Savannah River Site cannot safely be kept in their current forms, and must be stabilized to protect plant workers, the public and the environment. Some of these materials are liquids, which must be solidified. Others are irradiated nuclear fuels (containing highly enriched uranium) and production targets (containing plutonium) which are corroding in their storage basins. In a memorandum dated December 20, 1994, the Secretary of Energy committed the United States to not using the plutonium-239 and highly enriched uranium resulting from these operations for nuclear explosive purposes.

Plutonium-238 is used as a power source in remote applications, including NASA deep space probes. Some nuclear weapon designs use plutonium-238 power sources. The incremental cost (beyond the base costs being paid by EM for facilities maintenance necessary for other purposes) for processing this material is being paid for by the Department of Energy's Office of Nuclear Energy.

Plutonium-242 is used in the Department's research and development programs. The decision to use plutonium-242 will be analyzed in another, future EIS before a decision is made. However, stabilizing the plutonium-242 solution is necessary independent of its potential future use.

If, upon the conclusion of the NEPA process, decisions are made to process materials in the Canyons, and assuming that the canyons will be operated until 2002, we estimate the incremental costs of processing materials could be as given in Table 1. More detail about these activities is provided below.

F-Canyon

The Department is currently processing a total of approximately 303,000 liters (80,000 gallons) of plutonium-bearing liquid in the F-Canyon, to be completed in February 1996. Because of the potential risks associated with continuing to store this material as a liquid, the Department decided to solidify these solutions by processing them into plutonium metal. The Record of Decision (ROD) from the F-Canyon Plutonium Solutions Environmental Impact Statement (EIS) for this material was released to the public in February 1995. This action responds to the Defense Nuclear Facilities Safety Board's Recommendation 94–1, which expressed serious concern about the safety of stored nuclear materials at the Savannah River Site and other facilities, and to the Department's vulnerability studies on its plutonium inventories.

Processing of other materials in F-Canyon for stabilization is under consideration. The materials being considered for F-Canyon are irradiated Mark-31 plutonium production targets and plutonium scrap. The preferred alternatives identified for these materials in the draft Interim Management of Nuclear Materials EIS are chemical separation of the Mark-31 targets and dissolution of the scrap, both followed by the production of plutonium metal. This alternative allows the quickest stabilization and can be done using existing facilities. This action also responds to the Defense Nuclear Facilities Safety Board's Recommendation 94–1 and to the Department's vulnerability studies.

H-Canyon

In the draft Interim Management of Nuclear Materials EIS, EM is also considering processing nuclear materials in the H-Canyon at SRS. The preferred alternative in the draft EIS is chemical separation of Mark-16 and Mark-22 production reactor fuels, and solidification of liquids containing plutonium-239, plutonium-242, neptunium-237, and highly enriched uranium (HEU). The final EIS is scheduled to be released in late July 1995. The Department of Energy is reconsidering the preferred alternative for the management of the Mark-16 and Mark-22 fuels, as well as some miscellaneous aluminum-clad targets. It is expected that the preferred alternative(s) for the management of these materials will be announced in the next 4 to 6 months. If processing is selected, the HEU separated from the production reactor fuels and in the existing HEU solutions would be blended down to low enriched uranium (LEU), which cannot be used to produce a nuclear explosion, prior to solidification. As with the F-Canyon, these alternatives allow the quickest stabilization and can be done using existing facilities. These actions also respond to the Defense Nuclear Facilities Safety Board's Recommendation 94–1 and the Department's vulnerability studies.

In addition to the above materials, an Environmental Assessment for Operation of the HB-Line and Frame Waste Recovery at the Savannah River Site for production of plutonium-238 has been completed. The incremental cost (beyond the base costs being paid by EM for facilities maintenance necessary for other purposes) for processing this material is being paid for by the Department of Energy's Office of Nuclear Energy. Stabilization of neptunium-237, which is used to produce plutonium-238, is also addressed in the Interim Management of Nuclear materials EIS. There are no current plans to use the neptunium to produce any additional plutonium-238. However, the highly radioactive neptunium needs to be solidified because of the risk and expense of continuing to store it as a liquid.

Regardless of its potential future use, the plutonium-242 at the Savannah River Site cannot safely be kept in its current liquid form, and must be placed in a more stable solid form. Use of plutonium-242 will be decided by another EIS.

Foreign Research Reactor Spent Fuel

The Department of Energy is also considering chemical separation of returned foreign research reactor spent fuel containing uranium of U.S. origin. Some of this uranium is highly enriched. In the separation process, this uranium would be blended down so that it could not be used to produce a nuclear explosion. The draft EIS prepared by EM for this material explicitly indicates that chemical separation of the fuel is a non-preferred alternative, but is included for evaluation as a reasonable alternative. Selection of chemical separation would be premised on whether it can be demonstrated to be necessary for reasons of health, safety, or cost.

Table 1.—Incremental Costs of Processing Nuclear Materials at the Savannah River Site

Material	Amount	Total incremental cost (dollars in millions)
F Canyon:		
Pu-239 solution	303,000 liters*	$9.2
Mk-31 targets	16,000 slugs* 151 metric tons 147 metric tons heavy metal	27
Unstable Pu scrap	2,800** packages*	92
H Canyon:		
Pu-239 solution	37,000 liters*	12
Pu-242 solution	13,000 liters*	12
Np-237 solution	6,100 liters*	48
HEU solution	228,000 liters*	17
Mk-16 and 22 fuels	1,900 assemblies*	69

Table 1.—Incremental Costs of Processing Nuclear Materials at the Savannah River Site—Continued

Material	Amount	Total incremental cost (dollars in millions)
Foreign research reactor fuel	43.4 metric tons 6.7 metric tons heavy metal up to 22,700 elements*	1,350–2,150***
Unstable Pu scrap	up to 100 cu. meters up to 19.2 metric tons heavy metal 2,800** packages*	150

* The amounts of plutonium, highly enriched uranium and neptunium-237 contained in these materials are classified information. Classified information can be provided to appropriately cleared individuals upon request.

** 2,800 is the total number of packages at the site. It is estimated that approximately half of these packages (containing the majority of the plutonium) will require only heat treatment and repackaging, with the remaining packages requiring processing to permit safe storage. This processing would be done in both the F and H areas.

*** If selected, processing of foreign research reactor spent fuel would continue beyond 2002.

Senator LEVIN. The Department of Energy's fiscal year 1996 EM budget request of $6.6 billion initially looks like an increase over the current year's $6.1 billion appropriated. But $843 million of that request is for new "transition activities" work at former production sites including Savannah River, SC; Mound, OH; and Pinellas, FL for which the EM program is taking over safety and management responsibilities. What has been the cost of safety and management activities at those new sites under Defense Programs?

Mr. GRUMBLY. The cost of safety and management activities for Defense Programs fiscal year 1995 at the Savannah River Site was $836,728,000.

Safety and health costs at the Mound and Pinellas sites are as follows:

[Dollars in millions]

Site	Fiscal year	
	DP 1995	EM 1996
Mound	$60.8	$51.7
Pinellas	50.5	49.0

Senator LEVIN. Is EM being allocated sufficient budget authority in your request to cover these new costs and obligations? Will there be a shortfall for these activities or for those responsibilities EM already has?

Mr. GRUMBLY. The fiscal year 1996 budget request of $843 million for new scope associated with transfers (e.g., Mound, Pinellas and the Savannah River Site) from other programs was developed following careful consideration of all new obligations represented by these transfers. EM is managing activities at the Savannah River Site this fiscal year and is actively involved with the ongoing efforts aimed at completing the safe shutdown of Mound and preparing the Pinellas site for transfer to the private sector in fiscal year 1997.

In fiscal year 1996, EM will be responsible for surveillance and maintenance activities required to maintain the safety envelope at these sites. Additionally, EM has developed detailed plans and schedules to stabilize plutonium and other special nuclear materials at Mound and Savannah River to reduce safety concerns to the workers, public, and the environment. No such materials exist at Pinellas. Further, the $843 million budget request was developed to allow EM to reduce the out-year costs of these facilities through a series of deactivation activities. These include but are not limited to consolidating nuclear materials and reducing or eliminating numerous chemical and physical hazards.

This budget request is adequate to allow EM to address the most critical safety issues in the near-term without compromising its ongoing mission at other sites. It also is adequate to initiate several deactivation efforts that will result in significant "mortgage reduction" in the future. The $843 million is sufficient to fund the work planned for fiscal year 1996 without being excessive.

Senator LEVIN. Last month the Department of Energy completed a Baseline Environmental Management Report (BEMR) that projects a $235 billion, 75-year budget scenario for the cleanup program. What does that report say the impact would be if EM projects are delayed, in terms of additional costs and additional environmental, safety and health hazards?

Mr. GRUMBLY. The BEMR does include some analysis of the impacts of indefinitely delaying EM environmental restoration, waste treatment and decommissioning and decontamination activities. The results may indicate a reduction of total program costs in the short-term, but high annual waste storage and surveillance and maintenance costs would increase if known problems are not addressed. Long term annual costs for waste storage and surveillance and maintenance are projected in this circumstance to increase from $50–$75 million to $500 million for the complex as a whole.

Inadequate data were available to determine the full cost impacts of delay of EM projects. The Department intends to address this question in the second edition of the BEMR which will be issued in 1996.

The environmental and human health risks associated with such delays were not analyzed at all. However, risks to workers and affected members of the public could significantly increase under this approach if known hazards would remain unaddressed.

Senator LEVIN. What does the BEMR say about which types of production activities create the most costly and dangerous waste management and contamination problems?

Mr. GRUMBLY. The BEMR addresses the costs associated with discrete production activities in section 4.5. The report estimated total cleanup costs (which includes waste management) related to dealing with weapons legacy waste and contaminants at $172 billion. Of the eight steps in the production process, the largest contributor to this accumulated liability was chemical separations, which is responsible for approximately 52 percent of that cost. The next largest contributor was component fabrication at 20 percent. The percentages for the six remaining steps are presented below:

Fuel and Target Fabrication—9 percent.
Irradiation—6 percent.
Enrichment—6 percent.
Research, Development and Testing—5 percent.
Mining and Milling—.4 percent.
Assembly—.2 percent.

Senator LEVIN. How much will it cost the Department of Energy to address the most recently identified plutonium, chemical and spent fuel hazards around the weapons complex?

Mr. GRUMBLY. Some nine hundred million dollars of DOE's fiscal year 1996 Environmental Management (EM) budget is for transition activities work at former production sites which include Hanford, Rocky Flats, Savannah River, Oak Ridge, Idaho, Mound, and Pinellas. Cost information on these sites follows:

[In millions of dollars]

Site	Vulnerability	Cost fiscal year 1996
Hanford	Plutonium	$61.64
	Chemical	
	Spent fuel	102.956
Rocky Flats	Plutonium	280.1
	Chemical	2.65
	Spent fuel	
Savannah River	[1]	410
Oak Ridge	Plutonium	.2
	Chemical	12.713
	Spent fuel	10.10
Mound	Plutonium	1.36
	Chemical	1.04
	Spent fuel	
Idaho	Plutonium	
	Chemical	
	Spent fuel	23.693
Total for fiscal year 1996		$906.452

Mound.—Mound has Pu-239 which is being repackaged by the Office of Defense Programs in fiscal year 1995. If not shipped back to Hanford, EM will maintain this material at Mound. Its cost of $6.8M is included in surveillance and maintenance (S&M). The single enriched uranium spent fuel core is included in the S&M cost also. There are significant chemical inventories at Mound, particularly explosives which are funded under deactivation and compliance

Pinellas.—Pinellas has not plutonium or spent fuel hazard and insignificant chemical hazards. Chemical hazards are included in the safe shutdown cost and funded under deactivation and compliance.

[1] The nature of the facilities and activities at Savannah River result in co-processing of materials. As such, costs have been reported as a single consolidated figure.

Senator LEVIN. Some in Congress are contemplating even deeper reductions in the EM budget. For the record, could you explain what the impact would be on each site of general reductions in your budget of 15 percent or 25 percent in fiscal year 1996, including:

— How long cleanup and waste management projects would be delayed;

— Impact of delays on Department of Energy compliance with consent orders, major Federal environmental laws (CERCLA, RCRA, etc.) and Department of Energy safety orders;

— Number and type of major continuing or additional environmental, safety, public and occupational safety risks that would exist as a result of the reductions; and

— Direct and indirect job loss that would result at each site.

Mr. GRUMBLY. A 15 to 25 percent cut in the Environmental Management budget could have a devastating impact on the program's capacity to clean up nuclear waste and safely manage nuclear materials. At this time, it is not possible to fully describe which specific projects and associated compliance agreements, DOE Orders, and environmental laws will be affected and how long delays may occur for each activity in the program. However, we can estimate site level budget and employment impacts based on overall reductions.

In summary, cuts of this magnitude would:

—prevent upgrades of certain safety systems and cause widespread delays in cleanup progress;

—cause significant job losses including loss of vital expertise;

—result in numerous violations of current legal obligations; and

—increase long-term costs of the program.

For example, deferral of certain safety upgrades such as fire emergency systems and radioactive waste monitoring devices would occur. I cannot tell you exactly where or when a safety incident might happen, but the nature of these risks is too dangerous to test the margins.

It is also important to understand that cuts of this magnitude will increase the overall cleanup costs since delays in projects would be inevitable. Delays in cleanups and waste disposal projects may cause conditions to deteriorate, making the problems more severe. If required, we could defer certain "lower priority" activities. However, simply because a project is deemed "lower priority" in no way makes it "optional". Deferring cleanup obligations will only increase the risks and costs, and burden another generation of Americans. Additionally, deferring some cleanup and waste management projects will mean violating currently enforceable compliance agreements.

Moreover, the proposed cuts would result in elimination of thousands of additional jobs, including individuals whose expertise has been developed over decades and cannot easily be replaced.

If the Environmental Management budget were reduced by these amounts, it would significantly impair our ability to make needed progress in dealing with the Department's environmental legacy, as well as developing new technologies for the 21st Century.

QUESTIONS SUBMITTED BY SENATOR JOHN GLENN

Senator GLENN. In fiscal year 1994, the Office of Management and Budget authorized you to hire 1,200 additional staff to help better manage the environmental cleanup program. The Office of Management and Budget awarded these additional FTEs as part of a pilot project under the Government Performance and Results Act.

You subsequently allocated the 1,200 new FTEs to your field and headquarters offices, claiming that they could save about $300 million in productivity improvements and other saving in fiscal year 1995. I understand that you then deducted that $300 million from your fiscal year 1995 budget. You also claimed that the new FTEs would enable you to reduce your contractor work force. For fiscal year 1996, the productivity savings from these new hires is supposed to exceed $600 million.

To date, what success have you had in hiring the 1,200 new staff? Please provide the committee with statistics on the types of employees hired, the locations where the new FTEs have been assigned, and the areas of the EM program where they will be working.

Mr. GRUMBLY. To date, approximately 900 of the 1,200 positions have been filled. EM offices in the field and at headquarters have filled approximately 800 of the 1,020 positions allocated to them. One hundred and eighty positions were allocated to other offices within the Department which support the EM mission, such as the Office of Environment, Safety & Health; the Office of Human Resources and Administration; and the Office of the General Counsel. Approximately 100 of those positions have been filled.

EM has been able to track closely only those 1,020 positions that were allocated to EM field and headquarters offices. The EM field offices received 831 positions and EM headquarters received 189 positions. Approximately 700 positions in the field and 100 positions at headquarters have been filled. See the attached chart for a breakout of FTEs allocated to each site and the number of positions filled as of April 30, 1995. Of the 800 positions filled between EM field and headquarters, approximately 69 percent of them are technical (program and project managers; engineers; scientists; and environment, safety and health specialists) the remaining 31 percent are administrative. See the attached chart for a breakout of the types of positions filled.

	Allocated/Filled	EM FTEs	
	Office	Allocation	No. Hired
	Headquarters	189	100
	Albuquerque	108	93
	Chicago	33	29
	Idaho	34	34
	Morgantown	11	11
	Nevada	36	29
	Oakland	40	40
	Oak Ridge	77	68
	Ohio	106	88
	Richland	158	136
	Rocky Flats	100	90
	Savannah River	128	82
	Total	1020	800
	Positions Filled		Types of EM
	Type of Positon		% of Total Hired
	Program Managers		16
	Project Managers		8
	Environment, Safety, and Health Spec		17
	Cost Analysts		8
	Engineers		15
	Scientists		5
	Administrative Personnel		31
	TOTAL		100

Senator GLENN. What impact has the new staff had on your Federal employee-to-contractor ratio? What results are expected by the end of the fiscal year?

Mr. GRUMBLY. OMB allocated 1,200 additional FTEs to the Department of Energy, but only 1,020 were given to the Office of Environmental Management. To date, EM has hired approximately 800 new employees in the field and at headquarters. The addition of these 800 new Federal employees has lowered the Federal/

contractor ratio in EM from 21:1 to 16:1. We anticipate little change in this ratio by the end of the year because of the hiring freeze in the Department which will prevent EM from filling the remaining 220 FTEs allocated to it.

Senator GLENN. How did you evaluate the validity of the productivity improvement and cost savings that field and headquarters offices claimed the new FTEs could achieve? In other words, based on what the field told you—and what you accepted and put in your budget—we will see nearly $1 billion in productivity savings by the end of fiscal year 1996. Are you still confident that this will be achieved?

Mr. GRUMBLY. Environmental Management (EM) used a competitive bidding process to justify the allocation of new FTEs. Offices competed for the new FTEs by submitting written bids detailing staff needs, expected productivity improvements, and associated cost savings. For the field sites approved to receive new FTEs, their budget allocations were reduced by the cost savings projected. Operating contractors at the field sites are required to provide operating plans which assume hard dollar savings resulting from productivity/efficiency to carry out an established program baseline with less dollars. Progress in meeting productivity/efficiency commitments are monitored and reported to the Department of Energy by the operating contractors. Operating contractors are expected to demonstrate that their reported cost savings have been reviewed and are correct. Federal EM staff at the field sites are expected to independently validate cost savings reported to them. In addition, a quarterly report to headquarters is provided from the field sites which assesses their progress in achieving cost savings against commitments and is supported by detailing initiatives taken. For fiscal year 1995, Environmental Management is committed to cost savings of approximately $508 million of which $351 has been achieved. This compares to an initial fiscal year 1995 commitment of approximately $300 million. Environmental Management is significantly reducing real costs by a number of productivity/efficiency initiatives in place or planned which should result in the expected cost savings of roughly $613 million projected for fiscal year 1996.

Senator GLENN. How are you tracking and verifying productivity improvements and savings achieved by the field and headquarters offices? What is your assessment of the results to date, and what is your expectation for the rest of fiscal year 1995?

Mr. GRUMBLY. As indicated in a related question, Environmental Management establishes productivity/efficiency commitments as a key element of the contractor's operating plan at the field sites. Environmental Management approves the contractors' operating plans and requires them to monitor and report results in achieving productivity/efficiency cost savings. The field office's Environment Management staff evaluates the cost savings information reported to them and subsequently reports quarterly to headquarters on their progress. The initial fiscal year 1995 productivity commitment for Environmental Management was approximately $300 million. Cost savings reported to date are over $300 million and projected to be approximately $500 million by the end of the fiscal year.

Senator GLENN. The EM program currently has a number of management improvement initiatives underway. These have been started over the past 2 years based in part on advice from external and internal assessments of EM problem areas. According to the General Accounting Office, depending on how these are counted, there are anywhere from 12 to 23 currently underway. Obviously implementing and integrating these efforts will be a difficult task.

Please identify for the committee all of the management and improvement initiatives that EM is currently pursuing, and relate why each was begun and what the goals of each are.

Mr. GRUMBLY. The Office of Environmental Management has an aggressive, complex-wide productivity/efficiency improvement effort underway. Action plans are being implemented at each of the EM field sites as well as in headquarters to significantly improve the productivity/efficiency of the EM program. A major driver for the productivity/efficiency efforts was the findings of benchmarking studies comparing the performance of EM's projects with comparable projects in the private sector and other agencies. In essence, the benchmarking studies indicated the following:

- EM projects cost 32 percent more than the private sector projects and 15 percent more than comparable government projects.
- EM projects take significantly more time to complete.

In response to the benchmarking studies and to manage the new budget realities facing EM, the EM complex was challenged to achieve the following goals:

- Realize 20 percent cost reduction over the life of the project.
- Improve project completion time to be at least as good as other Federal agencies.
- Reduce project management costs.
- Reduce average project cost growth.

Each site across the EM complex has established action plans to achieve productivity/efficiency cost savings commitments. At the field sites we are reducing real costs by:

- Improving Contracting Strategies—incentivizing contractors to increase productivity and efficiency at Richland, Idaho, Albuquerque, Nevada, and Oakland.
- Reengineering the EM Work Process—accelerating schedules, consolidating tasks and changing processes at Rocky Flats, Oak Ridge, Ohio, and Albuquerque.
- Streamlining Assessments—negotiating changes with regulators, expediting facility characterizations, and using industry-generic specifications instead of government standards at Chicago, Idaho, Ohio, Nevada, and Savannah River.
- Reducing Project Support Costs/Overhead—minimizing waste, converting facilities and avoiding capital construction, delayering management, reducing administration, consolidating security, and reducing overtime at seven sites.
- Privatizing Activities—renegotiating contracts to utilize private sector expertise, implement make-or-buy programs, and outsourcing administrative services such as fire protection, laundry, graphics and sewer at Savannah River, Albuquerque, Oak Ridge, Idaho, and Richland.

In addition, complex-wide crosscutting issues are being addressed by joint headquarters/field groups to improve the tools, methods and processes which can assist the EM complex in achieving improvements in productivity/efficiency. These efforts include:

- Issuing guidelines to improve project definition and planning and streamline analysis.
- Share lessons learned in approaches to improve project management and control and reduce costs.
- Improve training and development to upgrade the technical and managerial competencies of EM's program and project managers.
- Foster efforts by the field sites to identify and use those requirements which are applicable and to recognize the true technical and managerial risks at a facility.
- Eliminate excessive and repetitive audits, reviews and assessments.
- Reduce/better control project support costs.

The EM budget for fiscal year 1995 included target productivity/efficiency cost savings of approximately $300 million with cost savings of more than $600 million projected for fiscal year 1996. At the present time, EM's efforts have already resulted in fiscal year 1995 cost savings of over $300 million which are expected to increase to approximately $500 million by the end of the fiscal year.

Senator GLENN. How are you planning to oversee and implement these initiatives?

Mr. GRUMBLY. In order to sustain productivity/efficiency progress and maintain an intensive focus on the need for additional cost savings, EM has established a Productivity/Efficiency Steering Committee made up of senior officials from both headquarters and field sites. This steering committee has been tasked to coordinate and take the lead in promoting productivity/efficiency efforts and improvements on a complex-wide basis. Further, EM is formalizing its complex-wide productivity/efficiency efforts. Productivity/efficiency performance objectives and criteria are being established to communicate management expectations, to provide guidelines for making productivity/efficiency improvements, and to serve as the basis for assessing overall productivity/efficiency performance. To be sure that EM stays on track toward meeting its productivity/efficiency goals and cost savings commitments, progress is being reviewed quarterly by means of field sites organizational self-assessments with independent headquarters validation. The results of the quarterly reviews are used as feedback for program improvements, as a means of sharing successful initiatives among EM sites, to provide management with critical performance information, and to demonstrate continuous improvement in EM effectiveness and efficiency.

Senator GLENN. You have also recently asked the National Academy of Sciences to help "reengineer" the EM program so that it can better cope with new budgetary constraints. What is the objective and cost of the proposed National Academy of Science study? What do you expect this study to reveal that you don't already know?

Mr. GRUMBLY. Faced with shrinking budgets, the critical requirement to develop a system that works better and costs less, and an immediate need for a total reengineering of existing systems, the Department has again turned to the National Academy of Sciences (NAS) to assist us in determining better ways to manage the clean up of the nuclear weapons complex.

The Academy has accepted a DOE proposal to conduct a multi-step examination of the scientific, engineering, and institutional barriers to achieving a more cost-effective stewardship of the Department's resources during clean-up.

The Academy will take a phased approach to conducting this examination, based upon the approach used successfully in preparing the report "Building Consensus through Risk Assessment and Risk Management of the Department of Energy's Environmental Remediation Program." First, several public forums and expert workshops will be conducted to encourage educational exchanges among stakeholders, scientists, and decision-makers. Both the workshops and public forums will provide the NAS with a wide range of options and observations to be used in the final step of its examination of DOE's clean-up program—an intense study scheduled to begin this summer, resulting in a report in December.

As I said when requesting the study, "this examination should be far more comprehensive than past analyses, which have involved subject experts in narrow fields. Given the enormity of the Environmental Management Program, it is envisioned that a comprehensive evaluation will be more successful if it is focused around a few broad areas of major concern." Thus, we expect this study to better reveal the interrelationships within the program—provide more comprehensive recommendations.

The Academy has indicated that the public forums will focus on the 'following lowing specific topics:

- Integration of science, engineering, and health in the implementation of the Environmental Management program;
- Evaluation of regulatory measures;
- Setting priorities, timing, and staging of activities. and
- Utilization of science. engineering and technology in the Environmental Management Program.

The study will be performed under an existing cooperative agreement with the National Academy (#DE–AC01–94EW54069), with funding up to $612,000 coming from the Office of Technology Development and the Office of Integrated Risk Management.

Senator GLENN. On April 5, the Department of Energy released revised "Section 3161" guidelines to deal with transitioning workers from production to cleanup in the nuclear weapons complex. I understand these are going to be published in the Federal Register.

This law is intended to make sure that the nuclear veterans of the Cold War, who served this Nation's defense nuclear needs, while being subjected to extraordinary radioactive and chemical hazards, are afforded an opportunity to continue working on the Department of Energy's essential mission of managing the environmental legacy of the Cold War. Many workers carry body burdens of plutonium and uranium from their work at Department of Energy facilities. And some workers were never notified that they carry these lethal compounds in their bodies. For example, this currently appears to be the case at Mound. Employers are understandably reluctant to hire workers who may carry these kinds of risks. The real and perceived stigma carried by these workers is an important reason why the Section 3161 hiring preference is so important.

As you know, I am an author of this legislation, and it directly affects three major Department of Energy facilities in Ohio: Fernald, Mound and Portsmouth.

This law includes, at its core, a requirement that the Secretary of Energy ensure that these workers are afforded a preference in any hiring of the Department of Energy, to the extent practicable, and that they are afforded retraining where needed. Of course, these workers have extraordinary knowledge and skills which are appropriate, in most cases, for the Department of Energy's new cleanup mission.

It therefore troubles me to review the Department of Energy's most recent Section 3161 guidelines, which appear to water down the hiring preference to the point where contractors may be under no obligation to hire these "veterans of the Cold War" even though they meet the qualifications of the jobs. For example, the new guidelines say:

- If the contractor determines that the hiring preference is inconsistent with contract reform objectives, they can waive the 3161 hiring preference;
- The Department of Energy will now subordinate Section 3161 to executive orders; and
- Qualified workers will not get the hiring preference if a contractor determines that based on "relative qualifications" non-3161 protected workers can be recruited—thereby pitting qualified 3161 protected workers against the non-protected workers. This is precisely the situation that occurred at Fernald, and a situation which I know you wish to avoid elsewhere.

Can you tell me why the Department has chosen to interpret 3161 in such a way?

Mr. GRUMBLY. The Department believes the new Guidance firmly supports section 3161 and extends and clarifies the intent of implementing the hiring preference. The language in the Guidance does not allow a contractor to "waive" the hiring preference, but rather advises that the preference be instituted at each tier of the process. The contract reform objectives under consideration by the Department are intended to strike a balance among a number of factors. These include: national security; health and safety; costs (both initial and life cycle) and efficiency; contractor work force diversity; impacts on the work force; and impacts on schedules, especially those contained in legislative, regulatory or Federal/State requirements.

Further, the Guidance states that the preference does not "outweigh other preferences required by statute or executive order." The language of section 3161 clearly states that terminated employees shall "to the extent practicable receive preference in any hiring of the Department of Energy," and continues to state that employees should receive preference to the extent "consistent with applicable employment seniority plans or practices of the Department of Energy * * * ."

The Guidance states that "where qualifications are approximately equal, eligible individuals will be given preference in hiring * * * ." It goes on to state that this preference must be balanced against veterans' and other preferences, seniority and other considerations. Again, the question of balance comes into play. Clearly we do not want an individual with substantially less qualifications to be chosen over a more qualified individual whether or not the less qualified individual has a hiring preference. At the same time, the guidance includes further provisions effectuating the hiring preference through training displaced workers to meet the qualifications required for new missions, if this can be accomplished at reasonable cost and in a timely manner. We believe that balancing the hiring preference against other requirements of a position is the process that must be followed in determining "practicability". We further believe the language contained in the new guidance, as I have discussed, substantially reflects this need for balance.

Senator GLENN. Do you concur with the content of these new guidelines?

Mr. GRUMBLY. I concur with the content of the Guidance and have found through discussions with field offices that it is helpful in offering guidance in carrying out the intent of section 3161, while allowing the flexibility necessary with the diversity of conditions at each affected site. However, we have labeled the Guidance as an interim document subject to public review and plan to publish it in the Federal Register. We welcome any thoughts on how it could be improved from you or other interested parties.

Senator GLENN. Are there efficiencies in capturing the taxpayer investment already made in these nuclear workers' training and institutional memory?

Mr. GRUMBLY. The training and institutional memory of many workers, developed through taxpayer investments in the nuclear programs at various sites, is often being used in the development and expansion of private sector business.

For example, at the Mound site in Miamisburg, Ohio, the Department has leased sites, facilities and equipment to the Mound Community Improvement Corporation which in turn has subleased parts of these resources to various companies. Several of these companies have hired a number of former Mound employees to work in areas such as machine tooling. In another case, a company was formed by former Mound employees at the site to pursue machine shop business. Several companies in the area have hired workers with chemistry and physics-related qualifications. One former employee is working to start up an environmental testing laboratory. Additionally, a General Motors subsidiary in the area has expressed strong interest in the use of facilities and equipment at the site, as well as the hiring of former employees.

Senator GLENN. Do you believe that the twin goals of contract reform and Section 3161 can be meshed?

Mr. GRUMBLY. The overall goal of contract reform could be stated as:

> "the redefinition of the site's mission and the restructuring of the site's work force to effectively and economically support the redefined mission."

The overall goal of Section 3161 could be stated as:

> "the restructuring of the site's work force to maximize the smooth transitioning of workers to new public sector or private sector work in the site's changed mission, to non-site-related work in the private sector, or to retirement."

Both goals involve the restructuring of a site's work force. Both envision a restructured work force able to more effectively and efficiently support the redefined site mission. Almost universally, changing missions and more efficient operations involve the loss of work for a number of workers. Understandably strong emotions accompany such loss. We believe the 3161 efforts support the overall goal of contract reform by:

(1) helping retrain some workers to support the site's redefined mission;

(2) assisting other workers to attain work for private contractors who gain site-related or other Department of Energy work;

(3) assisting other workers to find other private sector jobs either directly or through reeducation;

(4) supporting the early retirement of workers nearing normal retirement age and service longevity.

QUESTIONS SUBMITTED BY SENATOR RICHARD BRYAN

Senator BRYAN. During the past 2 years, 85 percent of all the Department of Energy's off-site low-level radioactive waste was disposed of at the Nevada Test Site (NTS). Yet, the Nevada Environmental Management Program only received approximately 1 percent of Environmental Management funds. What is the reason for this discrepancy? Can the Nevada Test Site expect to see increased Environmental Management funding in the future?

Mr. GRUMBLY. The low-level waste disposal program at the NTS is operated, in part, based on a fee charged to the offsite generators for direct disposal. These fees are in addition to the 1 percent direct allocation EM makes to NTS and provides NTS sufficient funds to operate its waste disposal program.

In addition, we are anticipating increases in the Environmental Management (EM) budget at the NTS in fiscal years 1996 and 1997. These increases will be applied to the Environmental Restoration program. However, due to severe budget reductions expected across the entire Department, EM funding at the NTS, as well as other Department of Energy sites, is not expected to significantly increase beyond 1997.

Senator BRYAN. Recently, the Department of Energy's effort to track ground water contamination at the NTS was cut back dramatically. Originally, the Department of Energy planned to drill or revamp 100 wells over 9 to 10 years. Now, the Department of Energy only plans to drill 44–49 wells by the turn of the century. What drove the decision to scale back this effort? To what extent will these cutbacks hurt efforts to track ground water contamination at the NTS? How reliable are efforts to compensate for these cutbacks, such as the use of nuclear testing records to understand ground water movements? Are there sufficient funds available for analysis once the data is collected?

Mr. GRUMBLY. The project to track ground-water contamination at the Nevada Test Site (NTS), the Underground Testing Area Project, is in the process of being significantly refocused to use monitoring in conjunction with risk-based land use planning as the "remedy" for potential ground-water contaminated by underground nuclear testing. In cooperation with the Nevada Division of Environmental Protection, the Department of Energy is shifting from a focus on characterization of the ground water to installing wells for both monitoring the extent of contamination, as well as to help determine areas of appropriate water use on and around NTS. This effort will move into full swing with the completion of a site-wide ground-water model and risk assessment in fiscal year 1996.

The decision to refocus the Underground Testing Area Project was not a result of cutbacks in funding, but instead a collective agreement among the Department of Energy and the Nevada Division of Environmental Protection that additional characterization, while useful, would not change the eventual remedial action to monitor the ground water and manage risks based on results of the monitoring. The parties agreed that enough information was now known about ground-water flow and contaminants to begin installing a monitoring network. In addition, delaying implementation of the monitoring system would only increase the likelihood that ground-water contamination potentially harmful to human health or the environment would go undetected longer. The parties plan to document the remedial action as part of an Interim Record of Decision. Of course, further characterization-type data will be collected as each monitoring well is installed. This additional data will assist in locating subsequent wells as the monitoring network is installed.

At this time, it is not known how many additional monitoring wells will be needed for risk management monitoring of the ground water at NTS. However, there is tentative agreement to monitor six areas where underground nuclear testing was historically focused. The monitoring network will incorporate wells that already exist for monitoring ground water on and around NTS. At current and projected funding levels, 50 new wells will be in place by the year 2015. However, funding cuts to the Environmental Management program at the Department of Energy-Nevada would affect the rate at which the monitoring system would be implemented and the level of analysis, and thus reliability, of the data from the wells.

Because of the significant cost of drilling wells, the Department of Energy is maximizing its use of pre-existing information such as by evaluating the radiological source term for the risk assessment based on nuclear testing records. The use of this information does not come at any expense in terms of the reliability of the monitoring network. On the contrary, evaluation of the radiological source term is essential for understanding what contaminants may be present and in what quantities, and where they may potentially be released into the ground-water system. Also, as previously mentioned, the Department of Energy is using existing wells to augment the monitoring. For example, the Department of Energy Nevada Operations Office entered into an agreement with U.S. Borax to turn three mineral exploration wells into ground-water monitoring wells in Armagosa Flats to augment our understanding and ability to monitor ground-water quality off the NTS, but at a significant cost savings over drilling new wells. In fiscal year 1994, the cost savings in utilizing existing wells, as opposed to drilling new wells, was estimated to be $8 million.

Senator BRYAN. Please describe the level of environmental restoration activities at Nevada sites other than the NTS. For instance, what is the status of the remediation of surface soils at the Central Nevada Test Area? Are there plans to install characterization and monitoring wells at the Central Nevada and Shoal Test Areas?

Mr. GRUMBLY. A Federal Facilities Agreement is currently being negotiated between the State of Nevada and Department of Energy that will address, in addition to the NTS, environmental restoration at other Department of Energy sites in Nevada, including the Central Nevada Test and Shoal Test Areas, the Tonopah Test Range, and sites on the Nellis Air Force Range for which the Department of Energy is responsible.

The Department of Energy conducts annual sampling of monitoring and drinking water wells in conjunction with the Environmental Protection Agency at both Shoal and Central Nevada. In addition, preliminary risk assessments for these two sites are being incorporated into the Site-wide Environmental Impact Statement for the Department of Energy sites in Nevada. Results of these risk assessments and other modelling and risk assessment work will determine the need to install additional wells to address potential exposure pathways. In fiscal year 1996, the Nevada Operations Office plans to begin remediation of contaminated soils in drilling mud pits at the Central Nevada Test Site. With sufficient funding, remediation work at both Shoal and Central Nevada will be completed in fiscal year 1997, supporting the Department of Energy's Small Sites Strategy for completion of environmental restoration work at smaller Department of Energy sites by fiscal year 2000.

Remediation is also underway at the Tonopah Test Range (TTR) and the Department of Energy sites on the Nellis Air Force Range (NAFR). From various sites on TTR this year, over 20,000 pieces of ordnance have been removed, rendered inert, and the metal recycled. This is an important step in making the sites safe for workers to complete remediation. On NAFR, the Department of Energy is preparing for an interim action in fiscal year 1996 to remove "hot spots" of surface plutonium soil contamination from the Double Tracks Site. Of the various plutonium soil sites off the NTS, this is deemed the most important site on which to begin work since Double Tracks is on an active bombing range and because of its proximity to the town of Goldfield, Nevada. Results of the cleanup of Double Tracks will be used to plan for the restoration and risk management of the Clean Slate plutonium soil sites on the TTR. Finally, the Nevada Operations Office is working with the U.S. Air Force to post and mark the area of the "Small Boy" soil plume of plutonium and mixed fission products which extends from NTS onto NAFR. This interim action is important to prevent site workers from being inadvertently exposed.

[Whereupon, at 5:10 p.m., the hearing was adjourned.]

DEPARTMENT OF DEFENSE AUTHORIZATION FOR APPROPRIATIONS FOR FISCAL YEAR 1996 AND THE FUTURE YEARS DEFENSE PROGRAM

TUESDAY, MAY 2, 1995

U.S. SENATE,
SUBCOMMITTEE ON STRATEGIC FORCES,
COMMITTEE ON ARMED SERVICES,
Washington, DC.

SPACE PROGRAMS AND THE DEPARTMENT OF DEFENSE'S SPACE MANAGEMENT INITIATIVE

The subcommittee met, pursuant to notice, at 9:36 a.m., in room SR–222, Russell Senate Office Building, Senator Trent Lott (chairman of the subcommittee) presiding.

Committee members present: Senators Lott, Warner, Smith, Exon, and Glenn.

Professional staff members present: Jonathan L. Etherton and Eric H. Thoemmes.

Minority staff member present: William E. Hoehn, Jr.

Staff assistants present: Kathleen M. Paralusz, Deasy Wagner, and Mickie Jan Wise.

Committee members' assistants present: Samuel D. Adcock, assistant to Senator Lott; Judith A. Ansley, assistant to Senator Warner; Thomas L. Lankford, assistant to Senator Smith; Andrew W. Johnson, assistant to Senator Exon; Edward McGaffigan, Jr., assistant to Senator Bingaman; Randy J. Rydell and John P. Stevens, assistants to Senator Glenn; and William Owens, assistant to Senator Robb.

OPENING STATEMENT OF SENATOR TRENT LOTT, CHAIRMAN

Senator LOTT. Gentlemen, if you will go ahead and take your seats, we will proceed. We expect Senator Exon and others to join us in a few minutes, but we do want to go ahead and begin because we have a series of recorded votes this morning at approximately 11 o'clock. So, we want to make sure we are concluded by then. I'll go ahead and give my statement and then when Senator Exon arrives, he can give his.

The Subcommittee on Strategic Forces meets today to receive testimony on current and future Department of Defense space programs and issues. The purpose of this hearing is not only to review space acquisition programs, but to place these into a user-oriented context and to shed light on future space applications and trends.

We will hear from two distinguished panels. First, the Army, Navy, and Air Force will give an overview of their space programs and operational approaches. Next we will hear from a panel of outside experts on how the United States can maximize space as a force multiplier in an era of constrained budgets and revolutionary information technologies.

We have also asked our service witnesses to address space management and organization. The creation of the Deputy Under Secretary of Defense for space acquisition has been largely centralized in the Office of the Secretary of Defense. While this appears to be a positive step, we have a long way to go in reaching a truly efficient space management structure.

I am disappointed that we have not done more to integrate the Department of Defense and intelligence community space acquisition. While we seem to be pointed in this general direction, right now I see more signs of bureaucratic inertia than genuine progress. One way or another, we must ensure that the National Reconnaissance Office becomes increasingly responsive to the needs of our combatant commanders. At the same time, we must be careful not to undermine the National Reconnaissance Office's efficiency by infesting it with the bureaucratic practices that plague Department of Defense acquisition.

As we centralize oversight of space acquisition, we must also ensure that each of the military services is given adequate influence over space architectures and systems. While the Air Force manages the majority of the Department of Defense's space budget, the Army and Navy are the largest warfighting consumers of space products. Given this situation, I am not sure that it was wise to have the new Department of Defense Space Architect reporting through the Air Force Acquisition Executive. I am concerned that strengthening Air Force control over space acquisition will offset centralized Office of the Secretary of Defense oversight, dilute the other service's ability to influence space acquisition, and make it more difficult to merge Department of Defense and National Reconnaissance Office acquisition activities.

In looking ahead, we must achieve greater efficiencies with our space infrastructure and personnel. Greater use of commercial systems and practices is something that all the services should be striving for. Our second panel will be able to address this in some detail, although we certainly would welcome views and comments from our service witnesses.

The Department of Defense is currently initiating several new space architectures and systems that will significantly shape our space capabilities for the coming decades. New architectures for satellite communications, missile warning and tracking, meteorology, and space launch are being developed. These programs will require large investments over many years. The executive branch must work with Congress to ensure that we maximize these investments.

I urge my colleagues on this committee and throughout Congress to start focusing more on space issues. The world is becoming increasingly dependent on space. Control and exploitation of space have become the equivalent of our air superiority and mastery of the seas. Smart use of space can make the difference between superiority and inferiority on the battlefield, even victory and defeat. Increasingly, space capabilities are replacing or augmenting the traditional tools and operational concepts of warfare. If we are to remain the world's foremost military power, the United States must control this evolution.

I would like to welcome our first panel. Maj. Gen. Robert S. Dickman is the Air Force Director of Space Programs; Rear Adm. Philip S. Anselmo is the Navy's Deputy Director of Space and Electronic Warfare; and Brig. Gen. Peter C. Franklin is the Army's Assistant Deputy for Systems Management and International Cooperation.

Did I get close, Admiral, to getting that pronunciation right?

Admiral ANSELMO. It is Anselmo.

Senator LOTT. Anselmo. I have to get the emphasis right.

Admiral ANSELMO. You were close, though.

Senator LOTT. Okay, good. We will attempt to conclude our first panel on or before 11 o'clock, and at that point we will hear from Dr. Stephen A. Cambone, Senior Fellow at the Center for Strategic and International Studies, and Dr. Scott Pace, Policy Analyst for the RAND Corporation's Critical Technologies Institute.

I do want to say again we want to be as brief as we can, but cover all the details in view of our time constraints this morning. I would like to actually get the second panel on well before 11 o'clock.

Before recognizing our witnesses, let me see if Senator Glenn has any statement at this time.

Senator GLENN. I have no statement.

Senator LOTT. Let us go ahead and begin with our witnesses then. General Dickman.

STATEMENT OF MAJ. GEN. ROBERT S. DICKMAN, USAF, DIRECTOR, SPACE PROGRAMS (SAF/AQS)

General DICKMAN. Mr. Chairman, Senator Glenn, it is indeed a pleasure to be with you and certainly to resonate with the comments you have made. You have challenged us and the committee over the years to become more efficient, more innovative about how we do space, and I think over the past year we have made a lot of progress in that direction. I can best highlight that by going through our programs, and I have done that in the statement that I have submitted for the record. What I would propose is to provide some general overview specifically about missile warning, communications, navigation, and launch.

I am sure it has been difficult for the committee to keep track of the various programs that we have submitted over the last several years on missile warning, DSP follow-on, Boost Surveillance and Tracking System, Follow-on Early Warning System, last year ALARM, and this year the Space Based Infrared System.

In general, each of those changes represented a down-scoping both in terms of the capability reflecting the change in the requirements in the post-Cold War era, and reflecting down-scoping in cost reflecting the budget pressures.

The present program, what we call SBIRS, the Space-Based Infrared System, is actually fundamentally different from the programs we brought over in the past. It represents the coming together of the major communities that were all looking at fielding some sort of infrared system to track both long- and short-range missiles, the work being done by the BMDO, the work being done by the Air Force, and the work being done by the intelligence community.

Last summer the Assistant Secretary of Defense for C^3I led a cross-community study to try to bring those three efforts together. In fact, the program that is now being managed by the Air Force is intended to launch satellites to meet the needs of all three communities, satellites that would fly in geostationary and inclined orbits in 2002 and in low orbit 4 years later. They are now being managed under a common management team, sharing technology, bringing together requirements that were in fact overlapping and in some places contradictory, honed down to minimum essential needs, and for the first time probably the most effective demonstration we have seen so far, an integration of the management of both white and black world programs. The two program offices are working literally together on every aspect of the program.

The source selection for the high altitude part of that program is underway right now. The source selection for the flight demonstration phase of the low altitude program we expect to be completed in fact later today. The contractor that is selected will fly two satellites in 1998.

There's much to do in that program, certainly, much to come, but it is an affordable program. It has broad support across the community and it has relatively low risk.

It has also been a busy year in the military satellite communications business. The first Milstar satellite was launched just over a year ago in February 1994. The satellite has been turned over to Space Command. It was used to support the operations in Haiti, and it had the most trouble-free first year on orbit of any satellite that any of us in the business can remember. With the exception of a redundant fuse that failed shortly after launch, there has not been a single on-orbit based problem. It is especially remarkable considering that Milstar is by far the most complex satellite of its kind that has ever been flown.

The next Milstar launch is scheduled for September of this year.

After looking very hard at the technical risk associated with accelerating the advanced EHF program, the follow-on to Milstar, and comparing that to the scheduled risks associated with Milstar itself and whether or not we could bring the advanced EHF on board before we completed the deployment of the four Milstar II satellites, the Department concluded last November that the cost and schedule uncertainties were too great. We awarded the contract for Milstar satellites 5 and 6.

Because we now have that full constellation on contract, we have been able to work with the contractor to make some major steps toward streamlining the acquisition, reducing the number of military specifications on contract, the way we buy off on the satellite, and everything in between. We expect savings on the order of $100 million to be realized over the course of the program simply by acquisition streamlining.

We have also begun a series of life extension program studies looking at the Defense Satellite Communication System, the long-haul system that has been in place since the 1960s. The 3 additional years of life we would get from the extension program, which is requested in the fiscal year 1996 budget, would ensure that we could delay the replenishment of the constellation until the latter part of the next decade and that the satellite could be available to meet the CINCs' needs well into the next century.

The next DSCS satellite is scheduled for launch in July.

The entire architecture for military satellite communications is under review. The first milestone, the general concept of where we would go, is due to be completed in June, and hopefully we will make programmatic decisions by September so they can roll into the next year's budget process.

From my perspective—and I think it is shared by Admiral Anselmo with whom I have discussed this—the biggest challenge that we are going to have is to provide enough flexibility in our future satellite communications to keep up with the technology changes we are going to see in the ground system and the commercial communications industry. Simply buying more of the same is clearly not the answer.

The third of the systems that I would like to talk about, the Global Positioning System (GPS), is also a good news story but in a slightly different sense. The system is fully operational. In March 1994, we launched the 24th satellite. We have not required a launch since then. It is an example of the dynamics in the launch business, that in fact we were scheduled to launch last month, but because we had all good satellites on orbit, we slipped that launch. The launch would have been a waste of our limited assets. So, the "launch on need" concept that had just been developed by Space Command last year has already been exercised.

By not launching a replenishment spacecraft on schedule but rather waiting until they are needed, we have reduced the probability or the likelihood that we would have a gap in coverage after the year 2000 as we used up the assets we have on the ground. We have just four more satellites of the buy that is currently on orbit and 21 on contract. We need to be on contract for the replenishment with GPS sometime during fiscal year 1996.

I mentioned launch several times in my comments. Since the fall of 1993, the military's operational launch program has been 100 percent successful. The Delta II program, developed with McDonnell Douglas, continues to extend its world record of consecutive successful launches, now standing at 49.

The Atlas Centaur operated by Lockheed Martin both at the Cape and in the future at Vandenberg with its new strap-on variant is becoming the vehicle of choice for commercial as well as government users. Last year, with the failure of Arianne, we moved to Atlas Centaur to launch the Direct TV satellite. That launch was executed within 4 months. The capability is on orbit and making enormous strides in how we think about distributing information around the world.

Of course, Titan is up and running. Four launches in 1994, including the Defense Support Program on Titan; four more are planned for this year.

Last year there were many commercial launches from Air Force launch facilities, and this year will be the first time that commercial has exceeded government launch rates. We developed a very close working relationship with industry that carries over into our Evolved Expendable Launch Vehicle program that we have begun this year. In addition to providing a much lower cost to the military, this family of vehicles will become the basis for the commercial industry that can compete successfully on the world market.

There is intelligence community funding for the EELV as well, reflecting that close relationship and reliance on our Air Force boosters.

These accomplishments are certainly gratifying to those of us in the business and we hope to you in Congress who have provided not only the resources but in many of the cases the guidance that has us on the tracks that we are on today. But in themselves, they are technical marvels and not much more. It is what happens as a result of the satellite getting to the right orbit at the right time as designed and operating for its full lifetime, providing the right information to the soldier or sailor or airman that really matters.

You will hear from my counterparts, our principal customers, about the use of space. You have heard the same messages from the various CINCs who have testified before you. Space capabilities, as you suggested, are an integral part of our warfighting structure, regardless of service, regardless of theater. There is not a single space system that I have described, a single space system acquired by the Air Force, that serves the Air Force as its primary customer. That was true from the earliest days of the space program and it continues today. No question we in the Air Force are moving to quickly integrate space across our weapons systems. But that is not the point.

The reality is that space supports all the services, all the warfighting commands just as does airlift. We in the Air Force are proud to be the principal supplier of operational military space systems. It is a role that takes a significant and growing fraction of our budget. It is a role we have sought because we do it well, better than anyone in the world over a period of more than 35 years. And it is a role that we will evolve in the future in concert with the Department's space management initiatives to ensure that the men and women who fight for this country and our allies will continue to have the world's most respected air and space force over head.

Thank you for the opportunity to review briefly our programs, and I look forward to your questions.

[The prepared statement of General Dickman follows:]

PREPARED STATEMENT BY MAJ. GEN. ROBERT S. DICKMAN, DIRECTOR, SPACE PROGRAMS

Mr. Chairman and members of the committee: Good morning, and thank you for the opportunity to address the committee on the Air Force's space programs. The Air Force is the principal supplier of multi-user space support and services for the Department of Defense. As we look to a future of primarily U.S. based, smaller, highly capable, flexible, and mobile fighting forces, space systems will provide the global situational awareness and connectivity enabling warfighters to understand the battlefield even before our other forces arrive. Space systems provide the presence and force-multiplying support that will continue to enable our warfighting forces to better execute their operational missions.

The Persian Gulf war and other regional conflicts as well as peacekeeping operations in support of the United Nations have vividly demonstrated the operational value of our space systems.

Our space systems are the "global eyes and ears" of the military, and our supporting infrastructure provides the DOD the flexibility to ensure continued access to and exploitation of space. General Fogelman has referred to the concept of "virtual presence" afforded by space systems—on station, 24-hours-a-day as a deterrent to aggression and "first on the scene" when deterrence fails. The Air Force remains committed to providing space capabilities to ensure all the services retain the capacity to meet the challenges of a more diverse, less defined threat anywhere in the world across the spectrum of military operations.

As the key provider of multi-user space capabilities in the DOD, the Air Force must sustain and modernize a wide mix of space systems to provide early warning, communications, environmental support, navigation and surveillance to meet the needs of the joint warfighting team. As we saw in the Gulf war, these capabilities are essential to domination of the modern battlefield, and we remain convinced they will be equally essential in the future. The Air Force fiscal year 1996 Presidential budget submission for space reflects the unprecedented synergy we have achieved across the Army, Navy, Air Force and DOD agencies to support a comprehensive, validated mix joint requirements to ensure our warfighting capacity.

This morning, I would like to review with you Air Force plans to sustain and modernize existing DOD space capabilities to ensure the U.S. retains its leadership position in space.

SATELLITE AND GROUND SYSTEMS

Today, the Air Force owns, operates, and sustains a broad mix of space and ground-based capabilities to meet the spectrum of multi-service and joint warfighting requirements.

DSP

The best known of these, because of its role in Desert Storm, is the Defense Support Program, a fully operational, space-based, early warning space system capable of detecting the infrared (heat) signature of intercontinental ballistic missiles and other classes of shorter range missiles, such as the Scud, which dominated the scene in the Gulf war. This system has been "on station" since the early 1970s, and continues to provide adequate support for the near-term. The most recent launch of a DSP satellite occurred last December, on a Titan IV rocket with an Inertial Upper Stage. Despite its effectiveness, increased proliferation of short-range, fast burning ballistic missiles promises to tax this system beyond its capacity, so we are pursuing an initiative to markedly improve our capability to detect ballistic missile launches more quickly and accurately, to better meet this evolving threat.

SBIRS

As you know, we conducted an extensive study last summer to select the replacement for DSP. The Space-Based Infra-Red System (SBIRS) program will provide increased performance for the missile warning, missile defense, technical intelligence, and battle space characterization missions. SBIRS consolidated requirements, merged funding from previous programs, and now operates under an integrated management structure. This "system of systems" approach synergized previously independent "stove piped" infrared sensor programs resident in the military and intelligence space communities, and eliminated duplicative efforts. SBIRS is the first major DOD program that is fully integrated with the acquisition and deployment of a classified host system—an unprecedented step toward integrating our national security space efforts and reducing the overall cost of space capabilities.

SBIRS will consist of sensors located in Geosynchronous Orbits (GEO), Highly Elliptical Orbits (HEO), and Low Earth Orbits (LEO). Our plan is to address the high altitude portion of the architecture first, namely the GEO and HEO components, and achieve an initial satellite launch in fiscal year 2002.

Under the SBIRS program, the Space and Missile Tracking System (SMTS), the successor of the Brilliant Eyes program which was transferred to the Air Force from BMDO in fiscal year 1994, will provide the low altitude component of our space-based infrared architecture. For SMTS, we plan a Flight Demonstration System (FDS), proof-of-principle phase to answer technical issues before a decision to pursue an operational capability in the post 2000 era. At present, two contractors are competing to build the Flight Demonstration satellites.

SBIRS not only set a standard for cooperation between the military and intelligence community in the requirements and program definition area, but has been designated an acquisition reform pathfinder—an Air Force "lead" program—and will apply comprehensive acquisition streamlining techniques to accelerate the acquisition process and reduce overall program costs.

MILSATCOM

Military Satellite Communications or MILSATCOM is our most diverse space program. Within this mission area we are involved in a wide mix of programs.

The Defense Satellite Communications System or DSCS, is the backbone for DOD communications, and the workhorse in the Super High Frequency (SHF) segment of the communications spectrum. If we need high volume, secure communications, we turn to DSCS every time. Last year we told you DSCS could be maintained through the middle of the next decade—and we still stand behind that estimate.

In the Extremely High Frequency or EHF range, Milstar provides operational forces with secure, survivable, flexible, world-wide communications. The DOD restructured the Milstar program extensively 4 years ago, at congressional urging, to reduce costs and to account for changes in the international and national security environments. Overall, the restructure reduced program cost by 50 percent, deleted "heroic" survivability features designed for the Cold War, reduced the total number of satellites from 10 to 6, and adjusted the number of user terminals commensurate with force reductions and the changing threat.

The first Milstar satellite was launched in February 1994 and has already provided operational support to U.S. forces deployed to Haiti for Operation Restore Democracy. Army ground forces used the system to communicate off-shore with supporting naval forces, and to the CONUS support bases without dependence on terrestrial infrastructure. A second Milstar satellite is scheduled for launch later this year.

The program restructure also addressed the need for more capacity from Milstar to support multi-service, tactical operations. Consequently, the remaining Milstar satellites will host a much higher throughput, Medium Data Rate (MDR) payload that will greatly increase communications capacity and enhance warfighting support to tactical commanders. The first satellite with this higher data rate will be launched in fiscal year 1999.

Let me conclude discussion of MILSATCOM with a short review of an on-going, integrated effort undertaken by the DOD to develop a comprehensive plan to address military satellite communications requirements. Based on our ground terminal and projected life-times of the satellites on orbit, our MILSATCOM systems will need replacement between 2000 and 2010. This presented the DOD with an opportunity to plan for a cost efficient and coordinated architecture transition to take advantage of the fundamental changes occurring in information handling and communications technology.

The Department is nearing completion of a Satellite Communications Master Plan to guide all future planning efforts for domestic and international MILSATCOM. We are expecting the plan to be completed very soon, and we look forward to working closely with the other services, departments and agencies to implement the plan to meet our essential MILSATCOM needs.

GPS

For navigation, the NAVSTAR Global Positioning System, or GPS, provides reliable and accurate navigation and timing information worldwide, fulfilling a critical military need and providing a valuable civilian service. Warfighters in all the services rely on the GPS common positioning reference grid and the quality user equipment in the field. A full constellation of production GPS satellites has been operational since March 1994, and the most recent GPS launch was in March 1994 on a Delta II booster.

Our plans for fiscal year 1996 and beyond include maintaining the required constellation while reducing the need to contact the satellites as frequently as we do today, as well as reducing the overall operations costs once the satellites are on-orbit. To ensure our ability to continue to provide this enormously important military and civil capability, we have begun acquisition planning for the next block of satellites—Block IIF.

NPOESS

In the environmental monitoring area, we have made major strides to converge military and civil weather requirements. Last year both Congress and the President directed a consolidation of DOD and DOC polar-orbiting environmental satellite programs into a National Polar-Orbiting Operational Environmental Satellite System (NPOESS).

NPOESS consolidation activities are proceeding very well. Last October we activated the Integrated Program Office. Under the integrated program office construct, the Program Director will be from the Department of Commerce and lead system management and operations activities, and the DOD will lead acquisition activities. In keeping with this division of responsibilities, the Air Force will transfer Defense Meteorological Satellite Program (DMSP) satellite control operations to National Oceanographic and Atmospheric Administration (NOAA) within the next 2 years (by 1998).

Currently, the Integrated Program Office is working to identify the most cost effective approach for the NPOESS system in time to support a review and program start in fiscal year 1996, and we expect the first launch of an NPOESS satellite in 2004.

LAUNCH

Space launch remains essential to all of our space programs. In fiscal year 1996, the Air Force will provide the services and ground support infrastructure to launch, establish, and maintain the necessary mix of satellites on-orbit. The Atlas and Delta continue to be the workhorses for DOD payloads. We are currently funded to launch three Delta II boosters in fiscal year 1996 and to continue deployment of GPS operational satellites.

TITAN IV

Titan IV remains this country's only capability for placing our highest priority heavy payloads into polar and geosynchronous orbits. The Titan IV/Centaur provides a lift capability more than double that of the Space Shuttle for placing payloads into geosynchronous orbit. The program achieved a major milestone in 1994 with the successful launch of the first Milstar satellite using a Titan IV/Centaur upper stage, as the program transitioned into an operational phase with four successful launches in 1994. An additional nine missions are planned between now and the end of fiscal year 1996. Fiscal year 1996 will also mark the first launch of a new vehicle configuration, designated "Titan IV–B." The Titan IV–B configuration will host new electronics, upgraded solid rocket motors for improved reliability and performance, and a common core with standard mechanical and electrical interfaces for improved reliability and operational flexibility.

We now have 41 Titan IV vehicles on contract, and in fiscal year 1996, we will be finalizing our acquisition strategy for a limited buy of up to six additional boosters. This buy is needed to launch Air Force and national user payloads prior to the operational availability of new boosters under the planned Evolved Expendable Launch Vehicle (EELV) program. Until a new heavy-lift replacement comes on line to support national user payloads, Titan IV will continue to serve our needs well beyond the turn of the century.

EELV

Although our current fleet of launch vehicles performs well, our goal remains to reduce the cost of procuring and launching our payloads to orbit. Based on recommendations from studies such as General Moorman's 1993 Space Launch Modernization Plan, the Air Force has initiated the Evolved Expendable Launch Vehicle (EELV) program. The EELV program will focus on developing a single family of launch vehicles for both medium and heavy launch missions, and will provide a low cost approach for launching all DOD payloads. EELV is another Air Force lead program for streamlined acquisition.

For EELV, we are counting on *not* doing business the old way. Documentation and reviews will be streamlined and reduced. We are counting on maximum contractor control, flexibility and innovation. We intend to use a one page statement of objectives and let the contractors tell us how to meet them. We intend to have government imposed specifications and will manage the program using insight into whatever management controls the contractors use for themselves. Last, we intend to make this a cost constrained program.

Using our streamlined approach, we have already surprised a lot of people by getting out a draft Request For Proposal (RFP) so quickly, and we are planning to issue the final RFP by mid-May. We expect contract award in September of this year for the Low Cost Concept Validation Phase of the program, and intend to fly a medium lift vehicle with a low risk payload by 2000 and a heavy lift vehicle with a low risk payload in 2003.

AFSCN

For satellite command and control, the Air Force Satellite Control Network (AFSCN) is the primary DOD capability supporting more than 60 satellites with over 100,000 satellite contacts a year to ensure satellite state-of-health monitoring and successful satellite mission performance. In addition, the AFSCN also tracks supports U.S. space launches for the DOD, National, Allied, and civil space communities. Satellite command and control is an essential, yet somewhat unheralded capability in the space area, and provides the space "hands-on" equivalent of flying an aircraft or driving a tank or ship.

This capability consists of the computer hardware, software, transmission and receive antennas and supporting communications to allow us to access DOD and other satellites anywhere in orbit, anytime day or night. Consequently, we have efforts underway to sustain this capability, as well as implement initiatives to reduce the cost of satellite control through consolidation and modernization. For consolidation, in fiscal year 1996 the Air Force and Navy will interconnect their Satellite Control Networks, giving each service access to their satellites through the other's antennas. This is a significant first step leading to a single, integrated DOD Satellite Control Network. We are also supporting an on-going United States Space Command initiative to assess areas for possible integration across military and intelligence satellite control capabilities.

For modernization, simplified human-computer interface, commercial technology and products, integrated operator workstation designs, and communications networking are key areas we are looking at to ensure we retain a viable satellite command and control capability to keep our satellites flying.

CMC

In the command and control area, the North American Aerospace Defense and United States Space Command systems located at Cheyenne Mountain Air Force Station in Colorado continue to provide critical information to support Unified and Specified CINCs, Allies, and National Command Authorities decisionmaking. The Cheyenne Mountain Upgrade program is continuing to modernize the 20 year old hardware and greatly improve the software processing critical to providing rapid, early warning response for continental defense.

SPACE MANAGEMENT

Improved space management is also being institutionalized within the DOD. At the OSD level, Dr. Paul Kaminski, the Under Secretary of Defense for Acquisition and Technology has established a new Deputy Under Secretary organization for space, to provide one voice for DOD space. The new organization effectively integrates space-related functions from three separate OSD organizations and will focus on policy, architecture and integration oversight for space programs.

Dr. Deutch has also proposed establishing an integrated space architect for DOD and designated the Air Force as the lead service to plan and execute an integrated, multi-service DOD architecture organization working within the structure of the Air Force acquisition system. Secretary Widnall has proposed a moderately sized organization composed of representatives from all the services and agencies with stakes in space. This new organization will focus on future architecture efforts within the DOD, ensure integrated architecture planning for military space and consolidate and vest within a single organization responsibility for DOD space architectures that cut across the mix of military space missions.

As Dr. Kaminski stated in his March 23 testimony to the House Appropriations Committee, a two-phased approach will initially establish a DOD Space Architect who will report to the Under Secretary of Defense for Acquisition and Technology through the Air Force Acquisition Executive. The second phase will focus on improving integration and coordination of our defense and intelligence space activities, and establishing a fully integrated architecture planning function.

The Air Force is committed to execute the DOD Space Architect function with the Army, Navy and other agencies, and to fully support DOD plans to establish an integrated architect for national security space.

CLOSING

In summary, Mr. Chairman, more than ever before, the Nation's future military readiness is inextricably tied to space. Space capabilities are critical to both our warfighting forces and our Nation because of their unique capacity to gather, process, and disseminate information in direct support of a complex mix of military missions—from conflict to peacekeeping operations. There is no more flexible tool in the DOD inventory.

As we continue to innovate and find better ways to use space, we encourage and fully support other services' and agencies' initiatives to exploit these multi-user space capabilities. We remain fully committed to ensure the Air Force provides the requisite space- and ground-based capabilities and supporting infrastructure to facilitate their efforts.

The joint warfighters requirements are paramount, and the Air Force stands ready to continue to lead development, sustainment and modernization efforts to ensure the DOD's multi-user space capabilities are "on station" and ready when called.

Thank you.

Senator LOTT. Thank you. Admiral.

STATEMENT OF REAR ADM. PHILIP S. ANSELMO, USN, DEPUTY DIRECTOR, SPACE AND ELECTRONIC WARFARE (N6B)

Admiral ANSELMO. Good morning, Mr. Chairman, Senator Glenn.

Our naval strategy for the 21st century titled "Forward . . . From the Sea" highlights the forward-deployed nature of our maritime forces, operating in accordance with strategies and tactics which emphasize maneuverability. Naval expeditionary forces, shaped for joint operations, tailored for national needs and operating forward, from the sea, are the reason for naval dependence upon space-based support.

It is this critical dependence which underpins the Department of the Navy's Space Policy, which states that the Department of the Navy will integrate space into every facet of naval operations with the primary focus on tactical support to the warfighter.

You can expect naval forces to be on the scene, sailing in harm's way, ready to respond across a continuum from diplomacy to force application. This is forward presence. When you deal with crisis, you cannot afford virtual presence. The more significant the crisis, the more intense the demand will be on satellite communication assets, from low-capacity voice circuits to high-capacity imagery and intelligence nets. Much of this intelligence information will derive from space-based sensors with a vantage point far above the Battle Group theater of operations.

Today we have a requirement and a capability to directly downlink environmental and intelligence data to our carriers and a key performance parameter requirement for the space-based infrared system to provide direct down-link of tactical data for processing by the in-theater users.

Navy space experience is a very long and fruitful story. In 1958 we launched the first solar cell satellite, and in 1959 we launched the first navigational satellite system, Transit, and in so doing provided the first Department of Defense operational satellite control. That system is still in operation today. Navy's irreplaceable science and technology infrastructure was most recently the proud parent of Clementine, a small, inexpensive satellite built for the Ballistic Missile Defense Office, which eventually mapped the moon.

Navy was the first user of EHF communications, operationally with our fleet EHF packages used during Operation Desert Storm.

Today we continue to lead in programs directly supporting our mobile users, many of which you are familiar with. My statement has a lot of details about those programs. I am going to briefly cover for you the highlights. UHF Follow-On, the UFO program, designed first for UHF, and then with a follow-on EHF capability.

GEOSAT Follow-On, the GFO program, used many of the proven and innovative features of the UFO contract, and produced a small program for environmental monitoring.

Tracking, telemetry, and control, the Navy's satellite tracking capability and automated ground system.

And Challenge Athena, which you have most recently heard about from the CINCs, is a truly innovative space system solution which demonstrated timely delivery of high-volume national primary imagery data to afloat warfighters, as well as two-way connectivity for a variety of spin-off applications, including afloat telephone, telemedicine, and teleconferencing.

It is clear that the Navy has not only been highly effective, but also singularly efficient, and it is precisely these qualities we need to preserve and improve upon as we move toward integrating the management of space.

The Navy will actively support and staff the new organization consistent with the Department of Defense objectives to reduce manpower, reduce infrastructure, and streamline acquisition. We believe that this can best be achieved with an National Reconnaissance Office-like structure which is not dominated by any single service or agency. We should not retain a large infrastructure based upon our past programs, but a lean organization that builds upon commercial strengths and reduces the legacy of Federal agencies and large systems commands within the Department of Defense structure.

The brief point I hope I leave you with is that the naval focus on space is very tactical. Our warfighters need competitively priced space system support for the information-hungry battlefield, the flexibility to take advantage of technology as it advances in the marketplace, and the joint and integrated cooperation of all services and agencies.

Thank you very much for giving me the opportunity to make that brief summary.

[The prepared statement of Admiral Anselmo follows:]

Prepared Statement by Rear Adm. Philip S. Anselmo, Deputy Director, Space and Electronic Warfare, Office of the Chief of Naval Operations

Good morning, Mr. Chairman and Members of the Committee and staff. I am pleased to appear before you today to give you the Naval warfighter perspective on space.

NAVAL SPACE STRATEGY

Navy considers space to be a medium for exploitation by the warfighter, not a mission in and of itself, or some fourth dimension of the battlefield. Naval forces have long used space systems to support our tactical warfighting needs, including communications, reconnaissance, surveillance, navigation and environmental monitoring. It is this long standing tactical focus which distinguishes naval efforts in space. Our Naval Strategy for the 21st century, titled "Forward . . . From the Sea," highlights the forward deployed nature of our maritime forces, operating in accordance with strategies and tactics which emphasize maneuverability. Naval expeditionary forces, shaped for joint operations, tailored for national needs and operating forward, from the sea, are the reason for naval dependence upon space-based support.

NAVAL SPACE POLICY

It is this critical dependence which underpins the Department of the Navy Space Policy, which states that the Department of the Navy will integrate space into every facet of naval operations, with the primary focus on tactical support to the warfighter. We do this by:

— optimizing space-based support, ensuring the warfighter receives maximum benefit from all current space systems

— developing a cadre of personnel with specialized space expertise

— broadening naval participation in the development, acquisition, and operation of space systems which satisfy unique naval requirements.

All forces depend upon timely satellite communications and data flow. Unlike shore-bound garrisoned forces, we do not have recourse to hardwired communications; we cannot trail a fiber optic cable behind us. Thus the Navy's strong support of satellite communications programs across the board—UHF, SHF, EHF, military or commercial. Both Navy and Army have been strong advocates of the Milstar medium data rate capability for our tactical warfighters. Additionally, we believe that the commercial satellite communications market offers great opportunities for DOD to move large amounts of data around the globe.

NAVAL OPERATIONAL ENVIRONMENT

Envision, if you will, our Naval Battle Groups operating over all the oceans of the globe when a crisis erupts. You can expect naval forces to be on the scene, sailing in harm's way, ready to respond across a continuum from diplomacy to force application. That is forward presence. When you deal with crisis, you cannot afford virtual presence. The more significant the crisis, the more intense the demand will be on satellite communications assets, from low-capacity voice circuits to high capacity imagery and intelligence nets. Much of this intelligence information will derive from space-based sensors with a vantage point far above the Battle Group theater of operations. Precise location of Battle Group units relative to potential targets will be developed using Transit and GPS navigational satellites. Naval forces will view the latest near-real-time weather and oceanographic conditions from the Battle Group to the crisis area using data from DOD and civil environmental satellites. In short, much of the latest information which our forward deployed warfighters need to receive or need to provide relies on space systems. This is why the Navy and Marine Corps insist on an authoritative voice in how their requirements will be met by space systems in the future. It is also why mobile, forward-deployed forces present the greatest challenge for space system support and rely heavily on direct downlinks.

The Navy initiated efforts to exploit the Defense Support Program (DSP) system to provide timely tactical information to the warfighter, beginning in 1982 with the Slow Walker indications and warning program. Slow Walker led to the Army/Navy Joint Tactical Ground Station (JTaGS), currently deployed and operational under joint-service detachments in support of two theater CINCs. Today we have a requirement and capability to directly downlink environmental and intelligence data to our carriers, and a key performance parameter requirement for the Space Based Infrared (SBIR) system to provide direct downlink of tactical data for processing by in-theater users.

NAVAL SPACE EXPERIENCE

Navy has been involved in the exploitation of space from the very beginning. In 1958 we launched the first solar cell satellite; in 1959 we launched the first navigational satellite, Transit, and in so doing provided the first DOD operational satellite control; and in 1962 we demonstrated the first operational worldwide satellite communications. Our Geodetic/Geophysical Satellite (GEOSAT) was launched in 1985 to provide radar altimetry data, first for the mapping of the earth's geoid, and later, to provide essential sea-surface topography. Navy's irreplaceable science and technology infrastructure was most recently the proud parent of Clementine—a small, inexpensive satellite, built for the Ballistic Missile Defense Office, which eventually mapped the moon.

Navy has acquired DOD UHF communications satellite systems and the EHF packages on our FLEETSAT and UHF Follow-On (UFO) satellites, and executed some of the earliest contracts for commercial communications satellites for tactical use. Navy was the first to use EHF satellite communications operationally with our Fleet Satellite EHF package and afloat EHF terminals during Desert Storm.

The Navy Tactical Exploitation of National Capabilities (TENCAP) office continues to focus on enhancing national systems support to our warfighters. Operationally, the lessons of Desert Storm clearly showed that the most effective near-term way to enhance the contributions of national systems data was to improve processing and dissemination. Our current emphasis in this area is a direct consequence of that experience.

Navy has operated the Naval Space Surveillance System since the early 1960s; it is now an integral part of the U.S. Space Command space surveillance network. This system consists of a bistatic radar fence located on a great circle across the southern United States. It detects objects as small as 0.1 square meter in low orbits to 1 square meter in high orbits, determines their orbital element information by digital processing and disseminates satellite vulnerability reports to fleet and fleet Marine forces ashore and afloat.

Today, we continue to lead in programs directly supporting our mobile, tactical warfighters. For example:

— UHF Follow-On (UFO): A Navy program cited by DOD as the model for streamlined acquisition under the direction of a 17 person program office. The competitively-awarded, fixed-price multi-year contract (which includes commercial launch services) calls for turn-key delivery of operational satellites on orbit. While moving UFO from concept to first launch in 5 years, Navy was able to evolve UFO from UHF with an SHF broadcast, to UHF with EHF, to UHF with expanded EHF without major cost or schedule impact to the program. Our philosophy has been to minimize management personnel, procure on a fixed-price basis with performance incentives both positive and negative, and not forget that our task is to support the warfighter in a timely and affordable manner. Navy demonstrated the significant potential of the Direct Broadcast Satellites (DBS) to provide data at near T–1 capacity (1.544 megabits per second) in Project Radiant Storm in November 1994. We are now examining, with OSD, the feasibility of incorporating a DBS capability in later UFO satellites.

— GEOSAT Follow-On (GFO): Uses many of the proven and innovative features of the UFO contract, together with a six person program office, and applies them to a small satellite program for environmental monitoring. Currently, Navy is working with NASA to see how we might converge Navy's GFO program with NASA's TOPEX/Poseidon Follow-on (TPFO) program and most efficiently satisfy all of our requirements.

— Tracking, Telemetry and Control (TT&C): The Navy satellite control network, leveraged from national systems research and development, has been lauded by GAO and Congress as a generation ahead in DOD and the proper direction for the Department in the future. As a result of the U.S. Space Command Future Integrated TT&C Architecture Study (FITAS), Air Force and Naval Space Commands signed a memorandum of agreement which will result in Navy assuming control of all FLTSAT and UFO satellites as a first efficiency move. FITAS further recommended the maximum exploitation of off-the-shelf products available today.

— Challenge Athena: A truly innovative space system solution which demonstrated timely delivery of high-volume national primary imagery data to afloat warfighters, as well as two-way connectivity for a variety of spin-off applications, including afloat telephone, telemedicine, and teleconferencing. Last year's demonstration of Challenge Athena II during a 6-month deployment on board the U.S.S. *George Washington* surpassed all expectations. In the words of the Battle Group Commander, this system "changed the very complexion of battle group operations." The availability of commercial phone service was equally popular with our sailors, a feature the Commanding Officer lauded as "the most significant boost to morale I've seen in my 25 years in the Navy."

It is clear that Navy has not only been highly effective but also singularly efficient, and it is precisely these qualities we need to preserve and improve upon as we move toward integrated management for space.

SPACE MANAGEMENT

The Deputy Secretary of Defense has created the position of Deputy Under Secretary of Defense for Space, which provides a DOD focus and includes the participation of all services. We believe the DUSD (Space) represents a major step forward. Deputy Secretary of Defense also tasked the Under Secretary of Defense for Acquisition and Technology to map out the DOD plan to meet the fiscal year 1995 congressional direction that ". . . the Secretary of Defense and Director of Central Intelligence shall combine all DOD and intelligence space acquisition responsibilities into one joint office under a single Space Acquisition Executive." As Dr. Kaminski testified to the House Appropriations Committee on March 23, he intends to proceed in two steps. Step 1 calls for a DOD Space Architect; step 2 envisions the establishment of a National Security Space Architect. We in DOD realize, as you do, that step 2 is the goal; that is where the best opportunities for efficiency and savings will lie.

Navy will actively support and staff the new organization consistent with DOD objectives to reduce manpower, reduce infrastructure and streamline acquisition. We believe that this can best be achieved with an NRO-like structure which is not dominated by any single service or agency. We should not retain a large infrastructure based upon past programs, but a lean organization that builds upon commercial strengths and reduces the legacy of Federal agencies and large Systems Commands within the DOD structure.

As the Chief of Naval Operations has said, competition is the real driver. We should keep opportunities open for competitive innovation. Each service and agency has much to offer. Navy wants to lead in space acquisition where it is appropriate. A recent effort is found in the area of polar communications, where NRO, Navy and Air Force have teamed together to bring to fruition a cost-effective solution to the CINC's critical warfighting requirement for polar communications.

We view military satellite communications as a natural area for Navy leadership when we speak of acquisition, since Navy provides the preponderance of mobile user requirements and has a proven record of innovative satellite communications acquisition.

CONCLUSION

The point which I hope to leave you with is that the Naval focus on space is tactical. Our warfighters need competitively priced space system support for the information-hungry battlefield, the flexibility to take advantage of technology as it advances in the marketplace, and the joint and integrated cooperation of all services and agencies. Whatever the future Space Management organization looks like, Navy wants to be involved in a substantive way, to encourage healthy, collegial competition and innovation with other services and agencies so that DOD receives the most "bang for the buck." Thank you.

Senator LOTT. Thank you, Admiral. All of your statements will be made a part of the record. We will get all three of you to testify first and then we will have questions from Senators. General Franklin.

STATEMENT OF BRIG. GEN. PETER C. FRANKLIN, USA, ASSISTANT DEPUTY FOR SYSTEM MANAGEMENT AND INTERNATIONAL COOPERATION

General FRANKLIN. Mr. Chairman, members of the committee, thank you for the opportunity to represent the Army and address your questions on the Army's space program.

Although the Army is not perceived as having a large involvement in space, I would like to take this opportunity to let you know how space has become and is becoming integral to the way we fight today and in the future.

The Army's efforts in space are not well-publicized, primarily because our space efforts are smaller dollar programs than that of satellite procurement programs. The Army, though, has tremendous expertise and investment in the ground architecture for space. This includes network control, exploitation, and dissemination of extensive information transmitted from and through space.

The Army has extensive involvement in space for over 40 years. We have excelled in the early development of rocket launch systems. We developed the first communications satellite, SCORE, in 1958. Army astronauts participate in over 20 percent of the missions. We have grown over the years. In Vietnam we started off with two 40-foot dish antennas to transmit photos. In Operation Just Cause we added the capability to do satellite communications both strategic and tactical, as well as our Tactical Exploitation of National Capabilities Program (TENCAP), one of the most successful programs in the Army.

We flew to Operation Desert Storm and Operation Desert Shield perhaps the first space war from the Army's perspective where we added to those capabilities of satellite communications the capability to map, terrain analysis, position location, navigation, weather, and missile warning.

The Army is also the lead service for all satellite communications ground terminals and is the executive agent for the defense satellite communications system's ground terminals and the network controls.

Space is critical to how the Army fights. We are the lead user of space products. For instance, we have over 120,000 global positioning system user requirements on the digitized battlefield. During Operation Desert Storm, the land component used over 70 percent of the available satellite communications capability during the ground war.

The importance of space systems and how the Army uses these systems is increasingly linked to successful realization of the information-based Army of the future. Our emphasis on space is and will continue to be focused on in-theater support for the land warfighter, and our goal is to embed space in everything we do, our doctrine, our training, and our equipment, all the way down to the individual in the foxhole. Because of this increasing dependence on space and our lead as the ground system architect, it is imperative that the Army have a voice in the decision making process for any space system architecture design in operation.

Sir, thank you for this opportunity to speak. I await your questions.

Senator LOTT. Thank you very much. We will try to limit the first round to 6 minutes and then we will have another round if needed and time permitting.

Thank you all for your statements. I found them all very interesting and encouraging.

General Dickman, on occasion the Air Force has been criticized for not adequately taking into consideration operational needs of the other services in managing space acquisition, and obviously they have a very important role there and a dependence on that information. For instance, the handling of the Milstar communications system has been cited as one example, and with the newly created Department of Defense Space Architect reporting through the Air Force acquisition executive, how are we going to ensure that the other services are adequately represented and satisfied with their involvement?

General DICKMAN. Well, I think you have raised two issues, Senator. One is whether the Air Force in fact has been a good steward, and I would like to return to that. The other is the role of the architect.

To date we do not have an approved structure for the architect. The Department of Defense asked the Air Force to work with the other services in proposing a structure, which we have done, and that architect office would include both immediate representation from the services, the CINCs, and the defense agencies, people who would wear the patch of their original organization while they were serving with the architect, as well as substantial representation from all the services in the architect's office.

Although the architect would report, in the reporting chain, through the Air Force acquisition executive, it is our view that that person would not be physically located within the Air Force acquisition community. More likely he would be collocated with perhaps the intelligence community's architectural functions and would in fact service all the defense agencies and services equally. We do not view it as an Air Force office serving Air Force needs.

The question of stewardship—and in fact, the example of Milstar is a very interesting one. Over the past several years, the Air Force has been criticized for, if you will, walking away from Milstar. What we were doing during that entire period was trying to propose alternatives to a 100 percent solution. There is no question that to do Milstar in its full capability, as we see it today, could only be done by the Milstar satellite as we see it flying. But there were alternatives that could be done to achieve perhaps 70 or 80 percent of the capability for 50 or 60 percent of the cost. What we tried to do was engage in dialogues on whether we could get to that point.

Admiral Anselmo has suggested the need to go to more commercial practices, more streamlined programs. Milstar is not that. Milstar was an enormous development challenge, the most technically complex spacecraft of its kind ever built. What we were trying to do was to move to something with lower risk that would provide substantial capability although not 100 percent of the Milstar capability. When we dealt with our users, the answer was no, we want you to continue to build Milstar, and so we did.

We do not view that as a lack of stewardship. We view that as an effective steward trying to bring alternatives to the table that could provide comparable or slightly lower capability for a substantially lower cost. We would continue to do that across the board with the programs we fielded. Every system that has been referred to being used, with the exception of the UHF follow-on, has been fielded by the Air Force. So, I think we have been good stewards.

Senator LOTT. So, you will make an extra effort to make sure that they are all integrated and involved in the process and that these previous criticisms are being addressed?

General DICKMAN. Yes.

Admiral ANSELMO. We could add too. I will speak for the Navy on our part here. There have been some issues over the years, because of fiscal constraints, that have forced us to drop some requirements, one of them being the Polar Comms issue which we have been discussing up here on the Hill, and we are teamed together to solve that problem. General Moorman, Vice Chief of the Air Force, has been very helpful in working with the Navy to get that requirement met.

But the Milstar issue we all look at, and we say we have a requirement to have the Anti Jam, Low Probability Intercept (AJPI) Comms—the assured conductivity for the warfighter at sea and on the battlefield on the land side for both the Army and the Marine Corps. That is a very unique requirement which drove the Milstar process through the last decade, and we have all been very supportive of having that assured connectivity in some way that is anti-jam, et cetera, so that the user, as a last resort, is able to connect for critical information.

Senator LOTT. Well, I want to ask about Milstar a little bit more in a moment, but let me first move to General Franklin because many people do not realize how space-oriented the Army really is. You made that point very clearly in your testimony and you are by far the largest warfighting consumer of these space products and services. So, given that reliance on space, are you satisfied that you are adequately able to influence the space acquisition and operations so that you can assure that the Army's needs are met?

General FRANKLIN. Sir, we believe we are headed in the right direction on this. We need about five things, though.

One is we need to have a seat at the table for when we develop these requirements for these space systems.

Senator LOTT. Do you have that now?

General FRANKLIN. We think there is a way to get that and we believe that the——

Senator LOTT. I think you just said you do not.

General FRANKLIN. These are things we need to make sure that we continue to have or have in the future. I should be more clear on that.

Once the satellite is deployed, we need to make sure we continue to have access to the products.

We need to make sure that the products are down-linked directly to the Army warfighter.

We need to maintain control of our TENCAP program, and we need to maintain control of our ground terminals.

I think the key, though, to making the space architect work is to have a seat at the space management table. A defense board of directors with senior leadership as voting members we believe is a step in the right direction.

Senator LOTT. On Milstar—because we do have limited time—I want to ask about that. General Dickman, you indicated that the one that was launched last year has been trouble-free and that it was used in Haiti. As you know, this program has been attacked in the past on the floor of the Senate. We have been able to defend it, but sometime in the past I wondered about how aggressively committed some of our military witnesses were when they came before the committee.

So, I guess what I want to ask you is in laymen's terms, as much as possible, explain how Milstar and EHF provide the capabilities that you really need in terms of connectivity, low probability of intercept, and all that sort of thing, just so we will have a record that we can refer to when we get to this amendment on the floor of the Senate.

General DICKMAN. The kind of capabilities described by Admiral Anselmo are low probability of intercept and anti-jam, and they are a function of the frequency that the satellite operates at, and the ability of the satellite to be smart in the way it communicates. The earlier satellites, the UHF we have talked about, if you think of a light bulb on a table, would light up the entire room and wherever you were you could see that light bulb. So, you would be able to detect whether it was on.

Milstar operates at a higher frequency. If you think of a flashlight with a tube over the front, you do not know that the flashlight is on unless you are right in the beam. So, it is very difficult to detect it and very difficult to intercept it, so it would be very good for communications where you do not want to be seen or heard.

Similarly, if you have a comparable flashlight with a tube at the other end, because of the high frequencies, you can maintain that contact with high reliability. So, it is a very secure link that is very hard to jam or break once it is established. Milstar is a complicated system, but by virtue of that complexity, it allows you to send that beam up to one satellite, go across to another satellite, and down to your customer wherever that customer is anywhere in the world. So, the warfighter does not have to worry about land relays or knowing precisely where the other end of the pipe is. He or she simply dials in the customer that he or she wants to get to. So, it provides the low probability of intercept, anti-jam, and very reliable, assured access that the warfighter needs.

Senator LOTT. Is this something you enjoy having or is this something you need?

General DICKMAN. It is something that we simply cannot go to war without, the ability to have the kind of assured communications.

Senator LOTT. I believe my time has expired with this round. We will come back again in a moment. Senator Glenn.

Senator GLENN. Thank you, Mr. Chairman. I have several questions I would like to follow up on. One of them is Milstar. I guess we have a precedent here that gives me some concern. That is the ATARS program. I would appreciate comments on that because under ATARS, which was an Air Force led project, the first deliverables were supposed to go to the Marine Corps, but after numerous contract problems and after the Navy had already modified 31 F–18s for the ATARS package, the Air Force canceled the program and said they no longer had a requirement for tacair reconnaissance.

Since that time the Navy has assumed management of the project and I understand it is going along all right now. Also, after a change in leadership, the Air Force is now again pursuing a pod-mounted version of ATARS for the F–15s.

Now, in regard to Milstar, though, it seems the Navy has a greater interest in the success of the system, although the Air Force is responsible for carrying out its execution. The Navy has fought for the program. The Air Force has proposed canceling it several times.

Out of the CRS report that was dated January 11 of this year, it says, "The Air Force is responsible for carrying out the Milstar program, but it has proposed canceling it over the past several years because of its high cost and the lack of Air Force requirements for its capabilities. The Army and Navy have fought for the program because they have greater requirements for the secure jam-resistant features offered by Milstar and the funding does not come from their budgets. This tension when one service has to fund the program needed by the others has contributed to the battle over management of the space program discussed earlier. Although Milstar survived the 1995 budget process, Congress continues to be concerned about it and the Department of Defense's overall plans for communications satellites." It refers to some bills here, but last year we directed Department of Defense to develop a detailed architecture for tactical communications. A report is required by March 31, 1995.

Number one, did that report come in and if so, what was its conclusion? And would you all comment on the similarity between ATARS and Milstar that gives me some pause?

General DICKMAN. The report has not yet been submitted. It has been drafted. It is in the building in coordination, and we expect it will be to Congress within the next 2 weeks.

Senator GLENN. Within the next 2 weeks?

General DICKMAN. Within the next 2 weeks, yes. I think the history of Milstar terminations is behind us. What we were trying during those years was to propose alternatives to Milstar that would provide a lot of the capability for lower cost. That is behind us as I indicated earlier.

We are now on contract for the full constellation of four Milstar II satellites. We are committed to that. That is a done deed. We have worked through some acquisition streamlining that will save substantial dollars on that program and are working through the technologies so that beyond Milstar satellite 6, we could field a more affordable system that would provide either the same capabilities as Milstar or, depending on what terrestrial communication is available, whatever differences are appropriate depending on what our users require.

Senator GLENN. You do not want to cancel it now then.

General DICKMAN. No, sir.

Senator GLENN. Is that correct?

General DICKMAN. That is correct.

Senator LOTT. Admiral, I know you were involved with the ATARS program very intimately back in years past. Is there similarity here that we should watch out for?

Admiral ANSELMO. Senator, I honestly would say no based on my dealings—Major General Dickman and myself and the Army—we have been working very hard on the CINCs' requirements, validated and revalidated with the Joint Chiefs of Staff on Milstar. We are not going to jump ship on this program. It is very critical to us, and it is not similar to ATARS.

The philosophical change that occurred in the Air Force with Tac Recce and the canceling of the ATARS program was probably twofold. One, the mission started to get to be very difficult to fold into their airplanes as they decommissioned the RF–4s, which were the aging aircraft in the force, and two, the program was in some serious problems both technically and from a management standpoint. It is unfortunate that they had to leave that program as they did, and General McPeak did not make that decision easily, but he did make the decision loud and clear.

The thing that we did do was we made a very smooth handoff with General Israel from the Air Force and at that time my office in the naval aviation plans and requirements. We turned it over and we were able to salvage it and aggressively move ahead to provide the Marines the capability to put the photographic systems into their F/A–18s.

Not the way you like to run a program, but considering all the other external forces of cost and management and execution, the services worked as teammates in this case to take a bad situation and try to make a rose out of it. I know the Marine Corps was not happy with how that was handled initially, but it certainly has worked out well in the near term now.

So, to go back to Milstar, the services are arm in arm in this program. This is the CINCs' only assured way of communicating in time of crisis to give us an AJ capability. I am not where the discussions and the concern has taken us in the past, but if anyone has any doubt in their mind, that constellation is what the CINCs require on the battlefield and at sea.

Senator GLENN. I am glad to hear your confidence in what is going on right now because that kind of confidence in ATARS was not well-founded. Maybe it was a good hand-off, but it sure was not a good program up to that time, and we were depending on all this teammate bit you talk about to develop the system and it was not there. So, that is the reason I get a little jumpy when we are going through some of the same perturbations here on Milstar.

General, do you have any comments on that?

General FRANKLIN. Sir, just a comment that we fully support the Milstar V and VI program launch into space. We have been working very carefully with the Navy and with the Air Force on this to make sure our requirements are known and the requirements of our CINCs are known.

Senator GLENN. Back to GPS. We are really moving on GPS, both in a civilian way and a military way. Our airway system is going to one of these days be largely dependent on GPS. I have a hand-held GPS I use in my airplane flying back and forth to Ohio. Amazing stuff that thing is doing and it is a downgraded system, of course, with what the military can do. We are moving GPS over into weapons systems guidance with fantastic accuracies, things we could not have even contemplated in our wildest dreams a few years ago.

But what concerns me is the potential for jamming and for negating the GPS system at the most crucial time. I do not know whether you can speak about this in open session or not, but I would like a good rundown on where we stand with regard to security of that system because we have an awful lot of eggs in one basket on GPS as far as weapon systems guidance and navigation are concerned. This will be a very critical system to us in the future. General Dickman.

General DICKMAN. Well, I think you have hit the nail right on the head. It is an extremely capable system and it is one that we are going to rely on very heavily. I cannot go into very many of the details in open session. We can certainly close back with you on the details.

Senator WARNER. Speak slowly because I am interested in this answer. You cannot go into the details here, which I understand, but what can you say?

General DICKMAN. The Defense Science Board, the Air Force Science Advisory Board, and others have all reached the same conclusion: we have to have a way to deny the ability of an enemy to use GPS in a theater. We have to have a way to assure our own ability to use GPS, and we have to, therefore, reduce the vulnerability of our own platforms to external jamming. Three different challenges.

We have programs underway within the Air Force that address all three of those, upgrades to our receivers to improve our own protection against external jamming, programs that would provide for operational denial of GPS in restricted areas that would not, in turn, impact civilian aircraft outside the theater of operations, and ways that we can change the GPS system to ensure that in fact we can acquire the GPS signal in any environment.

We will be glad to meet with you in closed session or one on one to go through the details of those programs. They include advanced concept definition, programs funded by the Department of Defense, and work that has been done within the GPS Program Office in coordination with the other services.

Senator GLENN. Admiral.

Admiral ANSELMO. I will be very supportive to what he said. The Naval Security Group and the Naval Research Lab have put all their efforts into supporting the service teams to work the three issues that we are concerned with. It is not something we can discuss in open session, but the General has done a very good job of highlighting the three concerns that we all have.

We are putting our best technicians in our invaluable laboratories and scientists together to come up with the best solution for the warfighter and not put at risk the civilian commercial sector which is so benefited also by this constellation.

Senator LOTT. General.

General FRANKLIN. Sir, I would just also add that we are supporting in this role, but also that we are building more than the 20,000 pluggers which are far more precise and less susceptible to jamming. We are reviewing new equipment as it comes into the field and training to overcome jamming as we do in communications jamming.

We are looking at new technologies, which I cannot go into here but we can address in perhaps a closed session. But I will also tell you that the soldier still carries the compass and knows how to use it and also that what we are looking at in the future is for GPS to update inertial systems, navigation systems, so that as you become jammed, then your inertial navigation system can take over. So, there are many things that we are working in conjunction with both the Air Force and the Navy to make sure that we can handle these kinds of situations.

Admiral ANSELMO. In fact, I can add a little comment on that. I teamed with the Air Force on all the joint weapons programs in my last responsibility doing aviation plans and requirements, and that very issue of the new inertial measuring units solved some of the tactical problem of our concern for the increased accuracy of weapons. The GPS constellation would give us that as we come in from sea, and if somebody does decide to jam us in the battle area, the inertial measuring units are so accurate today that they have much less drift so we can maintain the precision of that weapon, get us into the target area, deliver it precisely, and get out even in the presence of some of this jamming.

So, there are a lot of technical issues here that we have the best of our scientists looking at to find out what the threat looks like, and then what we can do to counter that under certain circumstances. That review in closed session would be very educational for everyone.

General DICKMAN. There are two technical issues with respect to the civilian use that are very critical to us. One is the retention of selective availability, that is the ability to degrade the signal, such as you have seen in your airplane, Senator Glenn, and the other is to ensure that the second frequency that GPS uses, which is now the military frequency for the high precision system, is in fact retained for military use only and not civil. There is encroachment in both areas and we would appreciate any support you can give to maintain those as military capabilities.

Senator LOTT. It is time now for Senator Warner, but first I would like to ask if the ranking member would like to put a statement in the record or make any comments before we go on with questions.

Senator EXON. Thank you very much, Mr. Chairman. I will await my usual turn.

Senator LOTT. All right, sir. Senator Warner.

Senator WARNER. Thank you, Mr. Chairman. I wish to commend you and the ranking member for bringing this hearing. I would urge that whether it is today or at some time we do look at this GPS in executive session because I associate myself with Senator Glenn's question and have done a little independent research of my own in consultation with private sector interests on this question. It is of vital importance.

I would like to rephrase it slightly to the witnesses, even though you have given a general opinion and properly indicated to the committee that you are not able to freely discuss all elements here in open session of course. But here is my concern, and that is utilization of the GPS system by either terrorists or indeed a third world nation or whatever might be launching certain aggressive attacks against us, our allies, or our friends. How do you deny them the use of a GPS in perpetrating these attacks and at the same time allow civil aircraft the world over to function? That is the difficult nut to crack in my judgment. Is that being addressed, General Dickman?

General DICKMAN. Absolutely, sir.

Senator WARNER. Well, practically speaking, in open session we ought to be able to say a little bit about how you let a commercial airliner from any nation of the world that is functioning in coming in for a landing continue to rely on GPS without putting at risk the passengers and suddenly you have to shut it down because a third world nation is about to launch some sort of a strike utilizing the same system against ourselves or one of our allies.

General DICKMAN. There are three levels of denial, if you will, that all involve increasing levels of technology and increasing levels of security.

The first would be simply to degrade the signal, and that would impact civil aircraft as it would anyone else.

Senator WARNER. But this depends on the final approach and a 1-mile ceiling or something.

General DICKMAN. And we have no intention to do that. The second is to deny GPS to all users within an area, and if the area of conflict was the same as the area where that civil airplane were operating, either we would have to announce through NOTAMS ahead of time that the possibility existed that GPS would be turned off, or we would have to choose some other alternative.

So, we are working the technology for very selective denial as well, and I am afraid that I cannot go any more into that.

Senator WARNER. We are putting the world on alert that they better have backup navigational systems in air and surface and other situations in the event we have to go to this.

General DICKMAN. Perfectly stated, sir.

Senator WARNER. Good. I thank the Chair. Senator Glenn, it is something we can perhaps work together on.

Members of this committee, certainly the chairman, myself, and Senator Smith I know, have been very active in the short-range ballistic defense system. There is a standing tradition in this committee with flag officers that we can ask them their personal opinion which could well be different than their professional opinion or that is the degree to which they can exercise that. So, I am calling on now not only your professional but your personal opinion because I have held all along that our theater missile defense efforts could benefit greatly from additional use of space-based assets, particularly external from space-based centers.

Do you agree that we could deploy cheaper, more technically capable TMD systems more quickly than currently planned if we were to exploit the use of space and not have such restrictions as now being placed by this administration and to a certain extent previous administrations? General Dickman.

General DICKMAN. Sir, I think that the longer the range of the missile, the more space-based sensors will come into play. For a truly short-range missile, the space system's time line is so short and the radars are good enough that it probably does not. I would suggest that, whether space-based or not, what you would really like to do is to get the missile early in its flight rather than late, and space could help that, but so could other programs that get in the attack phase.

Senator WARNER. But could it not be done more cheaply and more expeditiously if we were to rely more on space-based assets to develop our deterrence?

General DICKMAN. The longer the range of the missile, the more true that statement is. For a very short-range missile, probably not. The systems that the Army is working on are probably as effective as we can make them. But as soon as you get to where the range of the missile is beyond the horizon, then space can start to help, and so the answer is probably yes.

Senator WARNER. But during the Gulf war, we relied very heavily on space-based to alert for the Scud missile is my recollection and certainly that was a short range.

General DICKMAN. Yes, sir.

Admiral ANSELMO. Yes, sir.

Senator WARNER. Admiral.

Admiral ANSELMO. I agree with that, sir, but those are 600 kilometer weapons and I am not sure whether or not we would call it short-range. I am not trying to argue with that point, but you are right.

The space-based assets were critical. Using those assets and the DSP's and stereo-optic, we are able to transmit that directly down to the user, and that is the first implementation of using the space-based asset tactically to get it directly down to the theater operators to alert the Patriot batteries which is in our statements, as you will see, the Joint Tactical Ground Station (JTGS) program, which is a long-term building block since the early 1980s, to get us to that kind of technology so that we can give the battle group commander, whether it is Marine or Army, on the ground the quick notification to get the weapons pointed in the right azimuth and direction to take on those kinds of threats.

Senator WARNER. My specific question is we are developing a whole new generation, and General Franklin will talk to Patriot II and other systems. And you have your own sea-based system which we are working on.

Admiral ANSELMO. Yes, sir.

Senator WARNER. Could we not make greater utilization of space and, one, save money, two, do it more expeditiously, and perhaps three, get a better system? Because there are some constraints placed by this administration and previous, not political, on the use of space-based assets to be integrated into the short-range defensive systems. So, Admiral, my question from your personal perspective, could not we use space more?

Admiral ANSELMO. Yes, sir. In my personal opinion, we could be more aggressive in the use of space to support those kind of land and sea-based missile defense systems.

Senator WARNER. And save money and do it more expeditiously?

Admiral ANSELMO. And do it more expeditiously. The potential to save money is obviously there, Senator, but I will not give you a personal opinion nor a factual position on that. We can always do more to save money.

Senator WARNER. I thank you. That is very candid and I appreciate it.

Senator LOTT. General Franklin.

Senator WARNER. Mr. Chairman, if you would just indulge me for another minute.

Senator LOTT. Yes, please, go ahead.

General FRANKLIN. I will not mention JTAGS since that was already mentioned, but it is a good example of how we do use space assets.

My personal view is as you—first of all, I believe you are going to have to have that lower-tiered ground-based system because you cannot afford leakers in this day and age. When you have biological, nuclear, and perhaps chemical warheads coming at you, you cannot afford leakers. That is the only way you can guarantee that.

Can we use more and more of space assets? I believe the answer is yes, and I would support the Navy on that. I think what we should be looking at then is extending the battle space of the systems that——

Senator WARNER. I missed one word. Extending the what?

General FRANKLIN. The battle space. You would have earlier alerting, earlier cuing, earlier fly-outs.

Senator WARNER. Correct.

General FRANKLIN. So, I think that would be useful for those systems, but I think the architecture of the Ballistic Missile Defense Organization (BMDO) is coming up with would support that type of earlier warning and cuing, but I still think the pieces that are there are still going to be necessary.

Senator WARNER. But do you concur that we could do it more expeditiously and less costly if we were to have greater reliance on space assets?

General FRANKLIN. I do not conclude that, sir. I would conclude that you can extend the battle space and maybe make the weapons more effective on the ground. I do not know if you will necessarily make them cheaper on the ground.

Senator WARNER. I thank you.

Senator LOTT. That is very interesting. Senator Exon.

Senator EXON. Mr. Chairman, thank you very much. Mr. Chairman, I just first want to congratulate you for holding this hearing, and I am very pleased with the good turnout that we have from members of the committee because I think it is a tremendously important overall field. As one who took the initiative very early on the GPS systems and brought about I think what is generally considered to be the original breakdown where the Department of Defense and the Department of Commerce decided to get together on the GPS situation, it is tremendously important.

Also, I would point out that we have made some great successes, especially all will remember that last year we followed an initiative that I started that led Congress and the President to jointly direct the consolidation of the Department of Defense and the Department of Commerce polar orbiting environment satellite programs that you have mentioned, General, in your statement. I congratulate you for moving very quickly on this.

Senator Warner brought up some concerns that many of us have had for a long time, and I think they are good ones. I have been following this behind the scenes with a great deal of interest. I would simply point out that GPS is so important to our future in development of technology and using it in some form so that we could get some return from it to help pay off some of these very expensive things that are so very necessary. So, I congratulate all of you for the openness that you have had in this particular area and I think significant strides are being made.

To answer Senator Warner's legitimate question about an airplane in descent under rather adverse conditions, I would simply say that I think we can talk about this to this extent in open session which you have already alluded to, and that basically is the situation that we are never, ever going to have a totally foolproof system if we can continue to develop GPS, as you are doing now, that is going to assure the safety of air passenger travel without any question.

There may be some emergency at some time in the future where you would have an airliner coming down at a very critical stage and have to abort the landing. There are ways that we all know to abort landings. I think backup situations where they could switch over to something next best to GPS under life-threatening landing conditions that have been outlined here is something we are going to have to insist or at least suggest that not only our operators, but other foreign sources that may be depending on this have some backup situations where a plane could pull out and do something else.

So, while those are legitimate concerns, I think you are moving, from what I know of it, very aggressively in that area.

Mr. Chairman, I would like to enter my opening statement in the record at this time, if I might.

Senator LOTT. Without objection, so ordered.

[The prepared statement of Senator Exon follows:]

PREPARED STATEMENT OF SENATOR J. JAMES EXON

Thank you, Mr. Chairman. I join you in welcoming our panelists today to space systems and space programs. Over the past several years, this committee has tried repeatedly to bring the concept of "jointness" to the attention of the highly parochial space mafias in the military services. I am sure our Chairman well recalls the endless hearings in which Navy representatives would testify to "The Navy this . . ." and "The Navy that . . . ," and the Air Force witnesses would do the same—all without the slightest hint of jointness.

As a last resort, the Congress last year mandated the bringing together under Dr. Kaminski's purview of a centralized space office, combining DOD and Intelligence acquisition offices into a single entity, under a National Security Space Architect. While this is an important beginning, Mr. Chairman, it remains to be seen whether we will continue to hear the same litany of "The Navy this . . ." and "The Air Force that . . ." from future witnesses. The truth of the matter is that the Nation can no longer afford three separate, parochial service space programs.

Mr. Chairman, I look forward to the testimony of today's witnesses on design of, and management of, the space systems on which our warfighters increasingly depend.

Senator EXON. I am going to quote briefly from it and ask you to respond to this, gentlemen.

As you know, Congress last year mandated the bringing together under Dr. Kaminski's purview a centralized space office combining the Department of Defense and intelligence acquisition office into a single entity under the national security space architect. While this is an important beginning, Mr. Chairman, it remains to be seen whether we will continue to hear the same litany of "the Navy this and the Air Force that" from future witnesses. The truth of the matter is that the Nation can no longer afford these three separate, parochial service space programs.

I apologize for being late and maybe you handled this more in your opening statement than I know of at this time. I would just first like to have each of you emphasize once again as to how far along we are in breaking down what has been somewhat traditional among the services to say, well, I have to have this and you have to have that. Are we making sufficient progress in that area in the view of you three witnesses today?

General DICKMAN. Senator, I think the progress will forever be slow because we have enormous expertise in each of the services in space and for any of the services to walk away from that expertise and to say it belongs somewhere else would be hard to do. For any of us to say let us put that entirely within the defense organization independent of the services, we think would separate the space acquisition from the operators from the warfighters. So, what we are trying to do, to grapple with, is how to merge it.

We are committed within the Air Force to total integration between the military space program and the rest of the national security programs and to complete openness in our acquisition programs with the other services.

Does that mean we are ready to get out of the space business and let someone else do it? No, it certainly does not mean that, but it means that we do not think of ourselves as providing an Air Force space program.

Senator EXON. Admiral.

Admiral ANSELMO. We are very dedicated to moving down the line with Dr. Kaminski to get to the integration of intelligence and what we will call the white world space acquisition.

We have a lot of success stories in my 15 years of working with space with the Army TENCAP and the Air Force TENCAP and the Navy TENCAP exploitation of national systems, add-on programs that were done very cost effectively, the effort we are putting forward now on Polar Comms to satisfy the CINCs. We have more innovative ideas between the three services I think than we can afford, but the technical resources are just unbelievable.

I think the real question for us in the Department of Defense—one, we know we have to get our infrastructure down, and the issue we really have to address is to get ourselves down to a streamlined organization that can successfully and distinctly satisfy the warfighters' requirements. And that is a careful process, because if we move too quickly down that line in reducing infrastructure and reorganizing, we may find ourselves without the very capability that started this whole process and that is to respond to crisis and support the warfighter. So, that is an important step for us.

We need to do this and keep the leadership of this Nation and the leadership of the aerospace industry in space. In other words, the job market and the Americans that are truly the leaders in this technical area—we need to preserve their viability. So, as we downsize the Department of Defense, there ought to be a good handoff in the commercial sector, and we need to assure that that handoff is done well so we can preserve jobs and the technologies so that the United States maintains its leadership in space.

This is not a simple equation for three flag or general officers to come up with a total resolve on that, but we are all committed to moving down that path to reduce infrastructure, streamline our personnel, and preserve the rightful place that the United States should have in dominance in space.

General FRANKLIN. Sir, we believe that we are on the right path with the Under Secretary of Defense (USD) for space and also for the Department of Defense space architecture.

The keys that we would like to emphasize is that we must make sure that we continue to make these joint, which we are.

The second is, though, we believe strongly that a Department of Defense space board of directors with voting members are key to successful senior leadership and also service involvement in all space architectures, policy, acquisition matters, management process, and organization.

We think that the final goal, the Department of Defense and the Director of Central Intelligence combination, had ought to be what we ought to march for, but we believe that the space architect is the proper way to go for that.

I think we are already seeing fruits of some of this interaction because we are looking now at the integration of not just looking at constellations in space, but how they affect the ground architecture also, and that particularly becomes important when you are talking about a Milstar follow-on. In other words, if you change the satellite constellation a little bit, it may have severe impacts on the cost of the ground savings. So, we are looking at those carefully.

Senator EXON. Mr. Chairman, my time is up. Thank you. I am reassured by your statements and I will have some further questions in this area.

I would simply like to tell the panel that Senator Warner and I represent the Senate on the Aspin Intelligence Study Committee. The matter that I just referenced comes up time and time again on this particular committee that is taking an overall look at our intelligence services, how we gather them and how we treat each service equally and fairly, for the overall interest of the security of the United States of America. We are making progress, and that committee is taking a very hard look at this. I wanted you to know that.

Thank you, Mr. Chairman.

Senator LOTT. Senator Smith.

Senator SMITH. Thank you, Mr. Chairman. General Dickman, I want to follow up on your response to, I think it was, Senator Warner's questions on missile defense. You emphasized that it was important to intercept missiles early in flight and that space assets can do this effectively.

But I want to focus on this point from both the counterproliferation point of view, as well as the direct military angle. We have a clear requirement here for a boost phase interceptor to eliminate the possibility of anything chemical, biological, nuclear, or whatever, especially multiple warhead missiles.

Now, you mentioned that space is one option. Do you mean that in the sense that it is not the best option, or do you think it is the best option that we have?

General DICKMAN. I think it is probably not the best near-term option. I think the airborne laser or some kind of boost phase interceptor flying off an aircraft or off a ship if it were close enough would be far more fieldable in the near term. I think if we could get to a space-based system, it would provide both the strategic defense and theater defense that would be independent of whether a missile was long or short range.

Senator SMITH. Is it not true that some in the Air Force are advocating tactical fighters to do this?

General DICKMAN. Yes. The boost phase intercept that I referred to, in fact, would be a weapon on a fighter that would be flying combat air patrol over the area of interest in any case.

Senator SMITH. No, but the question is, are tactical fighters better than a boost phase interceptor?

General DICKMAN. I think a tactical fighter would carry a boost phase interceptor. A tactical fighter in itself cannot shoot down a missile.

Senator SMITH. I mean space-based. I am sorry. Is it better? Are you saying tactical fighters are better than space-based?

General DICKMAN. For a local theater, they are certainly more affordable.

Senator SMITH. That is not what I am asking you.

General DICKMAN. It is hard to say whether it is better.

Senator SMITH. Pardon me?

General DICKMAN. It is hard to say what the measure of merit is, whether it is better. For a local theater, the fighter-based BPI is probably better. It is certainly cheaper and it can do the job. For a wide theater or perhaps national missile defense, it would be far more expensive. It would be undoable with fighters, and so a space-based solution would be better.

Senator SMITH. So, using a wing of tactical fighters out in an area is less expensive?

General DICKMAN. The question is not deploying an entire wing. We have airplanes on combat air patrol, we and the Navy both, over any theater that we would be flying in. We would presume, because we would go take air superiority, equipping some or all of those aircraft with the ability to shoot a missile in its boost phase is not an impossible task, and it certainly does not require deploying additional wings to do that.

Senator SMITH. How long has the space-based laser been in development?

General DICKMAN. Probably in one form or another, 20 years.

Senator SMITH. The 1970s?

General DICKMAN. Yes, sir.

Senator SMITH. Is it ready? We can deploy that?

General DICKMAN. No, sir.

Senator SMITH. It is not readily deployable right now?

General DICKMAN. No, sir.

Admiral ANSELMO. No, sir. The only part of the laser technology that we were at a point that we briefed the Senate a few years back was the blue-green laser for the space-based communications for the submarines, that portion of it was in a demonstration phase that would have been able to go in space but was unaffordable.

General DICKMAN. I think we would be ready to fly within a short number of years a demonstration of a space-based laser.

Senator SMITH. How many years?

General DICKMAN. Probably 5.

Senator SMITH. Do you all agree with that, 5 years? A lot less, 2 or 3?

General DICKMAN. Flying any satellite in 2 or 3 years is very hard.

Senator SMITH. Mr. Chairman, I also want to reinforce the point that Senator Glenn made and Senator Warner made regarding the GPS. I think having some classified hearing where we can hear more about the reaction to that is critical because, as we are all aware, you can get these things in a mail order catalog. It is a very serious problem and I certainly would like to hear just how we would react to our adversaries if, in fact, they were to use these capabilities. So, I think I just want to reinforce that point.

I still have some time on my round here. The final area would be the Anti-Satellite (ASAT) program. In an open session, can you, General Franklin, tell me what would happen if an adversary used an ASAT system against us in the theater? What happens?

General FRANKLIN. Sir, I cannot answer that.

Senator SMITH. How does that affect our communications, our intelligence gathering? Can anyone respond to that?

General DICKMAN. I would suggest, sir, that General Franklin referred to Operation Desert Storm as the first space war. It was not a space war. It was a war where we used space because no one was shooting at space assets.

Senator SMITH. Well, it would have been a space war had the Iraqis had the ASAT capability, would it not?

General DICKMAN. Exactly right, sir.

Senator SMITH. And we would have lost a lot more lives.

General DICKMAN. And we have no capability to respond to that. Some of our satellites have some limited defensive capability, but not much.

Senator SMITH. Well, control of space then, you all would agree, would be an essential requirement in any future warfare; correct?

General DICKMAN. Yes, sir.

Admiral ANSELMO. Yes, sir.

General DICKMAN. We need to be able to operate in space and deny that opportunity to an adversary.

Admiral ANSELMO. And take some of the steps such as having the reserve satellites, terrestrially based, ready to go, having a ready on launch capability, be responsive. I do not know. Are you trying to lead me down the path of defending all of space——

Senator SMITH. No. What I am getting at is if the United States is in a situation where we have adversaries who have the capability to use ASAT against us, do we have an obligation to negate that before sending our troops into harm's way? Do you all agree with that?

General DICKMAN. Yes, sir.

Admiral ANSELMO. Yes, sir.

General FRANKLIN. Yes, sir.

Senator SMITH. Can we do that now?

General DICKMAN. That is a local CINC challenge. It is not exclusively a space challenge to do that. If Iraq was going to use something against our space systems, it would be CENTCOM's task to go take that out.

Senator SMITH. Thank you, Mr. Chairman. My time has expired.

Senator LOTT. In response to the suggestion from several that we have a closed or classified opportunity to ask more about the GPS program, we are looking at a time later on this week, maybe Thursday afternoon, that we could have an opportunity to do that.

Senator GLENN. Mr. Chairman, I am also on the Intelligence Committee and we have asked some questions over there on this subject. We might want to make this a joint hearing.

Senator LOTT. We are looking at Thursday afternoon as a possible time where we might get access to a room. So, we will get our staff to work on that.

Just a couple of questions in areas that we do not often get around to. Admiral, one of them is with regard to the joint weather satellite. It is a program between Defense, Commerce, and NASA. Are all of your requirements being satisfied with the arrangements you have there?

Admiral ANSELMO. Yes, sir. I will be brief to help you. We have combined everything with NASA, and the French, of course, are a teammate on this GFO II. We are going to go ahead. It looks like we have an agreement now to go ahead and do the encryption which will protect the information and provide us everything that we need.

Senator LOTT. I believe you mentioned, Admiral, that you do rely on commercial satellite communications, or maybe I discussed that before the meeting. Should the Department of Defense make greater use of the commercial systems and practices for space?

Admiral ANSELMO. Yes, sir.

Senator LOTT. General Franklin, on the Milstar communications program again, I had a distraction there, but you said something about the Milstar V and VI and indicated that you need those?

General FRANKLIN. Yes, sir.

Senator LOTT. What is your thinking on accelerated advanced EHF capability?

General FRANKLIN. Well, sir, I think what is key is to make sure that we do not have any underlap in the coverage, and I do not personally think that you can advance those fast enough so that you will have that coverage that you are going to be provided with Milstar V and VI in time at any kind of a reasonable cost. So, I believe essentially we need V and VI.

Senator LOTT. V and VI, okay.

General, what is the status of the Army's Secure Mobile Anti-Jam Reliable Tactical Terminal (Smart T) and Single Channel Anti-Jam Manportable Terminal (SCAMP) being developed to support the Milstar system? Are they adequately funded and is the program on schedule?

General FRANKLIN. Sir, the programs are on schedule and they are adequately funded, both of them.

Senator LOTT. Senator Glenn.

Senator GLENN. Thank you, Mr. Chairman. I will try to keep it short here. Back to the GPS for a moment. I know we are going to have a hearing later, but I am still very concerned. GPS solved big difficulties we had on Operation Desert Storm. This was the first time we used GPS, even some of the ground maneuvering was done with GPS systems so people would know where they are with relation to other units. So, we are becoming very reliant on these things.

Yet, one of our difficulties with all of our space-based assets has been getting information to the users. That was one of General Schwarzkopf's lessons learned out of the Gulf. We know we talked to some of the Navy people. They were getting information out of Riyadh 24 to 36 hours later than it was actually received. Marines were getting it even later. In fact, they were getting information after they had already flown some of the missions that they were supposed to be getting information for.

I know this is not your primary field, but could you comment on what we are doing with regard to making sure that after we spent all this money on all these exotic systems—and they are very good—that we get the proper information to the users? It does not do much good to pick up all this stuff and get it out there after the battle is over.

General FRANKLIN. Sir, we studied Operation Desert Storm very carefully to make sure that we could use these systems in the future better than we did. Of course, our TENCAP program still aggressively pursues getting that information down to the hands of the CINC as soon as possible. JTAGS is an excellent example of being able to take information off of Defense Support Program

(DSP) satellites to look at the location of the launch of Tactical Ballistic Missiles (TBMs) and also their impact points.

But I would say what we are pursuing the most is to make sure that we have a direct down-link capability from these satellites to the user on the ground, and I think that is where we are going to continue to push to make sure that that capability exists.

Senator GLENN. One of the big difficulties is making those systems secure so they cannot be jammed. We maneuver and depend on those things and then all at once, bang, they are jammed or somebody takes out a key satellite or something and we are back to square one again. That concerns me. How can we make GPS secure and not jammable.

Admiral ANSELMO. Sir, the TENCAP programs have been very supportive to glean any information from the national assets. We did not have a distribution network for Operation Desert Storm that met the users' and the warfighters' requirements. I think everybody recognized that from the war.

In the last 3 years, the explosion of information access has just been phenomenal, much of which is on the classified side, as I know you appreciate, but you can essentially take the imageries, the very details that the battle group commanders and the Marine commanders need in order to execute things on the battlefield—you can move that today instantaneously to them.

What you see in the commercial sector of the world today with video teleconferencing, real time, and automated telephones, and things that people are looking at for the future, 21st century, we are essentially realizing at sea today for the Navy and the Marine Corps and the Army forces, so as they move into the battlefield now, you literally are giving them T1 circuits which were available in the commercial sector here for a long time as a land line and put in at great expense. Today we are doing that on the ribbon of space. By using the satellites, both commercial and military, we are able to take that data and high usage data and put it right in the hands of the commander. So, it is exciting.

Senator GLENN. It is great and they are wonderful systems I agree, but the security still bothers me on these things because they still can be jammed. They are not jam-proof.

Admiral ANSELMO. Yes, sir. Well, Senator, we have the same concern you have. This again gets you back to the issue of SHF and of course Milstar, and that is why you need to maintain that area where you have the AJ factor. You always have to go back to that.

Senator GLENN. The SDI system seems to be going back into boost phase intercept and space-based systems, including lasers. I think we have to be very careful before we push too far. It will be exceedingly expensive. I mean, it is really going to be expensive. The threat has diminished from what it was before. Of course, a reconstituted Soviet Union would raise those concerns again. But we have a long way to go before SDI could be operational. I know back when we were at the height of that discussion, I thought that some of these systems were really pie in sky—not to make a bad pun—but it was really beyond our physical ability to put some of these things together.

Twice a year, I would make a trip to the places where we were doing the scientific work on SDI. The people doing the work out there would laugh and say we would be lucky if we had an operational system 20 years down the road. Developing 12-foot deformable mirrors, lasers, and then focusing out through the atmosphere to a golf ball size target will be extremely difficult to do.

We do not know how to do these things. We did not then and we do not now. If we are going to start programs like that, then they are going to be 15 to 20-year programs and we have to plan on that, and plan for the money to do them. We are unlikely to have them unless we enter into an all-out development program and that will be tremendously expensive.

That is more a statement than a question, but if you have any comment on it, why, feel free. [No response.]

Thank you.

Senator LOTT. Senator Smith.

Senator SMITH. Thank you, Mr. Chairman. Just a couple of follow-up questions. I just want to follow up and challenge you a little bit on your laser responses because industry sources tell me that we could launch a laser prototype by as early as 1998. You disagree with that. Let me ask each one of you. General Dickman?

General DICKMAN. I think that would be a very high risk program. You could dump a lot of money and maybe get there.

Senator SMITH. How much?

General DICKMAN. I have no idea.

Senator SMITH. Well, I guess my reaction—I am not trying to put you on the spot here, but my reaction is we have been in the development of this technology since the 1970s for 20 years. If it is high risk, somebody should have told us that a little while ago, do you not think?

General DICKMAN. Well, I think someone has. I do not think we have ever characterized, as Senator Glenn just alluded, a large space-based laser as a low risk development effort.

Senator SMITH. So, your response is that it could not be done before 5 years and if it were to be done, if we were to try to do it in less than that, it would be high risk.

General DICKMAN. Less than 5 years, I would characterize it as high risk.

Senator SMITH. Do you gentlemen agree with that?

Admiral ANSELMO. Senator, can I go back just a second for clarification? What we are proposing is to put a high powered laser up in orbit that would have the mega-joule capacity to be able to use it as a counter-ASAT device and have a constellation of those in orbit that could swing around and protect the constellations that we have.

Senator SMITH. Yes, and we are talking about a prototype for that by 1998.

Admiral ANSELMO. Ignoring the fiscal aspects of it—if we are going to start today, in 1998 that would be 3 years. Right now I know of no way, without throwing a lot of money at whatever the technology is, ignoring lasers or GPS, et cetera, if you are starting from scratch to put a payload up there, it is going to take you a minimum of probably 48 months. That is as good as we can do unless we start escalating costs quite dramatically off the typical learning curves.

That is, I think, the concern that Bob and I are expressing to you. If you ignore cost and you made it the number one priority for the Nation, you could probably put a demonstration payload up there of a smaller capacity laser to demonstrate the capability to do that on orbit.

I am doing this a little bit based on the work we have done in the past with the space-based laser for the submarine communications and my knowledge of basic space programs.

Senator SMITH. I do not know who is right and who is wrong here. My only point in challenging you on this is that there are those in industry who strongly disagree with you. I think we ought to make very clear that what might be risky politics is not necessarily risky technology and I asked you the question on technology not on politics. I am asking you on technology. Technologically can it be done in less than 5 years.

General DICKMAN. I have not tracked Zenith Star since SDIO was looking at it when it was still Strategic Defense Initiative Organization (SDIO), but that was a big laser demonstration in space. My personal assessment is we are 4 or 5 years away from being able to do something like that if we started right now.

Senator SMITH. Let me ask one final question. Should we restrict space-based sensors to cue theater missile defenses?

General DICKMAN. Is that now a technical question, Senator, or a political question? [Laughter.]

Senator SMITH. I know what the politics are. I am asking you the technical.

Senator GLENN. What did you ask, Bob?

Senator SMITH. The question was whether or not we should restrict space-based sensors to cue theater missile defenses.

General DICKMAN. The further out that the ground-based system, or however you intend to attack the missile coming in knows where the missile is, the better chance it has of shooting it down. So, seeing it over the horizon of space is the right answer technically.

Senator SMITH. So, you would agree that we should not.

General DICKMAN. Well, I agree we should field space-based systems to do that from a technical perspective.

Senator SMITH. Cuing?

General DICKMAN. Yes.

Senator SMITH. From space?

General DICKMAN. Yes.

Senator SMITH. Admiral.

Admiral ANSELMO. I would say as long as the warfighter demands that he requires the information necessary to cue and minimize the enemy's F-pole, his ability to shoot at us, we are going to have to not restrict the sensors in space. The drive for that should be the warfighter's needs which are based on his technical assessment.

Senator SMITH. I just want to be clear. Your testimony is that it would be not in the best interest of our troops in the theater, in the field to restrict space-based sensors to cue theater missile defenses.

Admiral ANSELMO. That is correct, sir.

General FRANKLIN. Sir, my point is that the systems that we are building now with Theater High Altitude Area Defense (THAAD), Patriot Advanced Capability (PAC–3), and Corps Surface-to-Air Missile (CORPS SAM) or will be building in the future take into account that they will operate without that cuing and they will provide that adequate defense in the theater missile defense area. Certainly again, as was pointed out earlier, any cuing you can get will not hurt you any, but I feel that the defenses that we are building now will adequately accomplish the mission that we need to do out in the theater without the cuing.

Senator SMITH. But the question is if cuing improves it, should we do it?

General FRANKLIN. Sir, that is a question for somebody else to answer but technically, yes.

Senator SMITH. That is all I am asking.

General FRANKLIN. Yes, sir. Technically, yes.

Senator SMITH. I am asking technically and also in terms of your own support for your troops in the field.

Admiral ANSELMO. The Navy and Marine warfighter would answer you with a big yes. If you have that information that will help me focus the weapons in the theater sooner and more accurately, I want the information.

Senator SMITH. Okay, that is an honest answer.

Thank you, Mr. Chairman.

Senator LOTT. Thank you, Senator Smith. Before I call on Senator Exon, I would like to ask the witnesses to return on Thursday, May 4, at 2 o'clock p.m., for a closed session regarding the GPS technology. Staff will coordinate advising members and get information to the panel of exactly where that will be.

We do have a full committee hearing on ABM Treaty and missile defense programs for that date. The time for that hearing has been moved to 2:30 instead of 2 o'clock, giving us the opportunity to have this 30-minute closed session on GPS technology. Senator Exon.

Senator EXON. Mr. Chairman, thank you very much. Gentlemen, along the lines that we have been talking about here—and there are so many different concerns here—on page 3 of this week's Space News—if you have not seen it, I would call your attention to it—there is a story about a report to the Secretary of Defense from General Shalikashvili. The story is headlined "U.S. Space Constellations Rapidly Deteriorating."

We have heard from each of you today about the future potential of space and the particular programs each service espouses. What I have not heard is anything about space constellations rapidly deteriorating.

Gentlemen, should we assume that General Shalikashvili is misinformed or is the story wrong? Or should we assume that you three did not want to bother us with these kinds of details?

Another way of saying it, this is a rather interesting story. I can wonder in this session, in this classification, whether you can shed any problems that you are aware of because this subcommittee is very much interested in all kinds of problems, minor or major. What can you tell me about your knowledge or lack thereof about the Space News article that I have just referenced?

General DICKMAN. Sir, the report, I believe, is one that is sent personally from the Chairman to the Secretary of Defense, so I have not read the report. But I believe that he is referring specifically to one constellation, and that is the Defense Satellite Communications System, and he is, in fact, referring in particular to one satellite within that constellation, the Indian Ocean satellite, which has been deteriorating and continues to deteriorate. That is the satellite that we have programmed a launch against for the 28th of July.

So, we are well aware of the situation that I believe he was referring to, the declining status of that constellation, and the fix is in work. The launch is in process. The spacecraft is at the Cape. The launch vehicle is on its way.

Admiral ANSELMO. The services work together. There was a big discussion on this issue with the J–6 who is in charge of all the communications across the Joint Staff. We worked out the launch sequence with UFO, which goes the end of May, which will provide the UHF side with EHF, and then the scheduling of the DSCS satellite which goes the end of July. This involved coordination with the CINCs, the warfighters, the theater representatives, and the Joint Staff.

So, we are well aware of what is occurring with the DSCS and all the services are coordinating their programs to try to make sure we satisfy the warfighters in a timely fashion. First shoot is to get UFO up, and that is number 5 the end of May here. If that goes successfully, then we will go back over and shoot the DSCS, and with good luck on both of those, maintaining our launch record here of late, we ought to be in good shape, and the article in question would be history.

General FRANKLIN. Well, sir, I am not familiar with that issue.

What we are developing in the satellite constellations that we are putting up—I think it is important to keep our eye on the dates when we need those and keep funding them adequately to make sure those happen or there could be some problems, I think. But I think right now I have nothing to add to what the Navy and the Air Force have said to that.

Senator EXON. Well then, gentlemen, if I hear you correctly, you are saying that the story may be overblown because there has been general knowledge in the community that we have deterioration in this one sector, as you have outlined, but with regard to the new satellite supposedly going up now, you have moved aggressively. If the new satellite performs as you anticipate it will, it would essentially eliminate any concerns in the area addressed by the Space News story. Is that a fair way to phrase what you are telling me?

General DICKMAN. Yes, sir.

Admiral ANSELMO. Yes, sir.

General DICKMAN. The constellation would be green at that point.

Senator EXON. Gentlemen, I will have some more questions for the closed session that I think would be more appropriately asked at that particular time, and therefore I appreciate very much your being here. We look forward to seeing you later on in the week.

Senator LOTT. I would like to add my appreciation to this panel. You did an excellent job. Thank you very much for being here.

Let us have the second panel, please. I might advise the members, we do have a couple of outside-the-Pentagon witnesses I think will be very interesting, Dr. Stephen Cambone and Dr. Scott Pace.

I might advise the members that the votes have not been ordered yet. It looks like there may be some delay. So, I believe we will be able to hear from these two witnesses at a minimum and then maybe have an opportunity for a few questions without missing any votes on the floor of the Senate.

If I could ask the witnesses to please come forward and the others, if you would, exit quickly because we are under some time constraints. Thank you very much for your cooperation.

Dr. Cambone, thank you for being here and, Dr. Pace, we appreciate your being here. We would like to ask you both to summarize your statements. Your complete statements will be made a part of the record, and that will give us some opportunity to ask some questions. Dr. Cambone, please proceed.

STATEMENT OF DR. STEPHEN A. CAMBONE, SENIOR FELLOW, CENTER FOR STRATEGIC AND INTERNATIONAL STUDIES

Dr. CAMBONE. Thank you, Senator. It is a pleasure for me to be here today. I should tell you that it has been some 15 years since I have been associated with space programs and my first opportunity to testify. So, I appreciate the opportunity to do that.

My comments are really going to pick up off of the statement made by General Dickman which was that Operation Desert Storm was really not the first space war, but in fact was a war in which space was used quite extensively by the Armed Forces. I would like to extend the argument to suggest that it is time that we start thinking about the use of our space forces in a broader context other than strictly support for operational level affairs.

Let me say first that with respect to our strategic forces and military forces in general, we have become exceedingly closely focused on the issue of the major regional contingency. While that is a useful way to think about force planning, I think what it has tended to do is to narrow our focus and our attention with respect to strategic forces in general and space in particular. Command, Control, Communications and Intelligence surveillance, early warning—those kinds of support activities—have really been focused down, quite frankly, with respect to their capabilities. We are tending to worry about the canonical 200 by 200 kilometer box, which you will hear Admiral Owens talk about quite frequently, which it turns out is about the size of the Kuwait theater of operations.

So, what I am suggesting is that as we are going forward with our concern for the MRC, we may be quite unintentionally beginning to restrict the focus with which we approach the question of space operations and space capabilities. I would suggest that that would be most unfortunate. Because, as we look out over the next 15 years or so, I think we are going to begin to see that the MRC, that is, the concern about the rogue state, the outlaw state, is going to recede in importance, and we are going to find ourselves worrying rather more in the first decades of the next century about the rise of a number of great powers. We already see Russia beginning to reassert herself. We know that China has begun to do so. There is some reason to expect that India would like to do so, and as we look around at Iran and Iraq and other states, we can see that they have great power ambitions as well.

So, in my view it is time we begin to think about making use of space and the capabilities we can put in, to and from space to begin to address the world in which great powers are going to be our competitors and in which we are less concerned about rogue and outlaw states.

Now, my concern here is buttressed by the fact that the general purpose forces that we are presently planning for the MRC operations are woefully underfunded. The work we have done at the Center suggests that we ought to be spending closer to 4 to 4.5 percent of gross domestic product in order to be able to afford the force structure that has been put forward in the Bottom-Up Review. The President has budgeted around 3 percent of GDP and quite frankly Congress does not seem to be anxious to spend more than about 3.5 percent of GDP on those forces. Therefore, it seems we are going to have a general purpose force that is going to be smaller, less technically superior in the future than the one we have had in the past and certainly than the one that we fielded in Operation Desert Storm.

But more importantly, despite the fact that our own forces will not progress at a rapid pace, I am concerned that those of the great powers I have mentioned to you are going to improve quite dramatically. Again, we can see in China a very concerted effort to develop on a selective basis those technologies which it will require in order to sustain its position as a great power in the next decades of the next century. I think you can see the same with India and you can see it with Russia as well.

Therefore, it seems to me we have to begin to get over the notion that we are going to deploy from the continental United States multiple corps based on 60-ton tanks, fly very expensive airplanes, armed with very expensive munitions, backed up by 20 or 40 strategic bombers all based here in the United States, all fighting at a very long distance. That is not the kind of force which is going to be adequate for the future.

Therefore, Mr. Chairman, I would argue that it is time that we begin to think about space as being an area in which we begin to develop an independent strategic capability to see, to talk, to hear, to attack, and to defend in order to be able to support the position of the United States as one of those great powers in the years to come. We have to be able to see, to talk, to target, to attack, and to defend in real time, and we have to be able to do it in a way in which we are able to dominate future combat and allow us to adjust, therefore, the capabilities of our general purpose forces overall.

We have, I think, Mr. Chairman, the means at hand to begin that kind of development. A discussion was heard here earlier of some of the advances and investments that have been made in the BMD program. Quite frankly, the Brilliant Eyes program has a satellite system which is ready to go and could in fact provide the kind of real-time surveillance and targeting we need. Indeed, we talked about the space-based laser. Another candidate, probably more successful still would be the free electron laser, which is based entirely on the ground other than its relay mirror system.

We have developed advanced telecommunications and C^4 capabilities to allow us to manage these systems in real time.

Therefore, it seems to me we have at hand the ability to begin to develop a credible strategic capability with our space assets, that it is imperative that we begin to do so if we are going to compete successfully against other great powers in the next century, and that toward that end, what we should begin to do, Mr. Chairman, I would argue, is begin to concentrate our efforts a bit more intensely in the areas of strike and defense, and in the area of an expendable launch vehicle to permit us to get to space with the assets I am talking about.

We need to begin to investigate ways in which we can combine the capabilities that are being developed in the civil sector for both communications and sensing.

And finally, it seems to me, we have to have, along with the new acquisition process that has been put together in the Defense Department, for which it is to be complemented, a corresponding single point of contact for the development of strategic concepts for space. I would suggest, Mr. Chairman, that that task should be given to the unified command out at U.S. Space Command and that USCINCSPACE should be given the responsibility to begin the process of thinking through precisely what it means to have a strategic capability to, from, and in space.

Thank you, Mr. Chairman.

[The prepared statement of Dr. Cambone follows:]

PREPARED STATEMENT BY DR. STEPHEN A. CAMBONE, SENIOR FELLOW, POLITICAL-MILITARY STUDIES PROGRAM, CENTER FOR STRATEGIC AND INTERNATIONAL STUDIES

INTRODUCTION

It is an honor and pleasure for me to testify before this subcommittee, Mr. Chairman.

The issue before the committee this morning is of central importance to the future capability of the Nation's Armed Forces and therefore of the Nation's security in the first decades of the 21st century.

In my testimony I will make three points:

— First, that in planning for the future capabilities of our Armed Forces we should not confuse the ethnic, religious and nationalist conflicts that are currently raging with the broad strategic challenges that are likely to face the Nation in the first part of the next century;

— Second, that existing plans and budgets for U.S. military capabilities will not result in military forces adequate to the Nation's strategic needs in the early decades of the 21st century;

— Third, that we have within our grasp the technical and organizational capability to develop and field a force adequate to our needs but that the opportunity to begin that process is fleeting and may evaporate by the end of the current FYDP.

STRATEGIC CHALLENGES OF THE 21st CENTURY

The Nation's attention has been captivated by the unremitting violence in the former Yugoslavia, Somalia, Rwanda and Burundi, the brutality and ferocity of Russia's operations in Chechnya, the acts of terror in Buenos Aires, Tokyo and Oklahoma City. In the wake of these events, and in the absence of the threats characteristic of the Cold War, it has become commonplace to describe ethnic, religious and nationalist conflict, war, and terrorism as one of the central security challenges facing the Nation.

A second challenge, of course, is that of the "rogue" or "outlaw" state—like North Korea, Iran or Iraq—armed with weapons of mass destruction and the means for delivering them and bent on aggression to achieve its aims.

While both certainly present the Nation with the need to marshal its diplomatic, economic, and military resources to uphold the principles of international law, defend the Nation's interests and lend support to allies, and to provide humanitarian aid, it is hardly persuasive to argue that either of them will long characterize the international environment and define the strategic objectives of the United States.

To suggest that neither ethnic, religious and national conflict or "rogue" states will not long characterize the international environment, is not to suggest that both will disappear or that the United States need not trouble itself with them. It is to suggest that there are larger, far more powerful trends now at work in the international environment that can directly and immediately affect the interests of the United States as they come into their own in the first decades of the next century.

These trends can be summarized by one word: consolidation. As one looks around the world, one can discern the efforts of a small number of states to develop regional groupings and associations to provide for political, economic and/or military security within their own region and to provide themselves with greater influence within the global community.

In principle, the United States has no opposition to this process. In the Western Hemisphere it is promoting NAFTA and a north-south free trade zone. And, as a power with considerable interests in many regions—Europe, the Middle East, South Asia and the Pacific Rim—it is an active participant and promoter of this process in those regions as well. For example, the United States remains interested in seeing the European Union become successful, in promoting the rapprochement among Egypt, Israel, and Jordan, reducing tensions between Pakistan and India and promoting APEC and the Asia Regional Forum.

Other states are engaged in the process, however. In Europe, both France and Germany have decided views on the character of the EU they prefer, and those preferences do not in all cases agree with those of the United States. In the Middle East, Syria, Iran, and Iraq have views hostile to those of the United States. India is determined to maintain its distance from the United States.

The two nations other than the United States that can lay claim to interests in multiple regions—Russia and the People's Republic of China—are working very hard to see that the consolidation process favors their interests. Despite its evident weakness Russia has managed to reassert its claim to international recognition and is attempting to shape the regions of concern to it—Eastern Europe, Southwest Asia, and Central Asia—in favorable ways. China, building on its recent economic growth, has asserted its interests in regions as far away as the Middle East, into the Indian Ocean and into the South China Seas.

Among these emerging great powers, the U.S. shares a history of peaceful relations and common security interests only with the states of the EU and as a result of the overlapping memberships between the EU and NATO. For the rest no such history exists.

The absence of such a history with Russia, China, India, and the states of the Middle East, poses the preeminent strategic challenge facing the United States into the first decades of the next century. The United States will be seeking to advance its interests in regions where these other emerging great powers have substantial interests as well. The United States would prefer to establish at the very least normal and reciprocal relations with other great powers and to avoid hostility. But our preferences alone will not govern the relationship. Thus, in pursuing our interests in multiple regions around the world the United States will need to anticipate those of other great powers and be ready to cooperate with them where that is possible and to defend American interests and those of our allies against them should it prove necessary.

It is this process of consolidation and establishment of new relationships among the new great powers that holds the greatest strategic challenge for the United States in the first decades of the next century. Positioning the Nation so that its interests are advanced and protected while avoiding unnecessary hostility and even conflict with the other great powers is the task on which the Nation should focus. Success in this task is critical to create an international system of relative peace and prosperity in which the likelihood of more Rwandas and Haitis is reduced and in which states are more willing to make common cause against states like North Korea, Iraq or other "rogue" states.

PLANNED CAPABILITIES INADEQUATE TO MEET THE STRATEGIC CHALLENGE

In meeting the strategic challenges of the next few decades, Mr. Chairman, the capabilities of our military forces will play a significant role. Along with our diplomatic and economic policies and capabilities, they will help shape the perceptions of great and small powers, friends and potential foes alike, of the capacity and willingness of the United States to give direction to the international system, to establish the norms of civilized conduct among states, and to represent and defend America's interest in the international system.

Our subject here is the Nation's military capabilities in the future. I will leave the issue of diplomatic and economic policy for others to address.

To suggest that our military capabilities will have a role in shaping the international environment is to suggest that they will have a strategic role to play. That is, they will help to influence the perceptions and actions of other great powers. They will provide a standard against which other power will measure their own capabilities, make judgments about whether they wish to cooperate or compete with the United States, and estimate the risks they will run if they choose a course of confrontation and aggression against the United States or its allies.

The nations likely to emerge as great powers in the next decades will have at their disposal military capabilities which will begin to rival those the U.S. deploys today. Europe, Russia, India, and China, to name but four likely candidates for great power status all possess space programs capable of launching satellites to geosynchronous orbits. All are presently capable of building their own satellites. All of them will have nuclear forces. All of them are working feverishly to incorporate the lessons they learned from the display of American military capability in the Persian Gulf in the areas of precision strike, stealth, command and control, and the like.

To be sure, none of them has yet equaled current American capabilities. But it is not the current gap between our perspective capabilities that should be of concern. It is the projected difference that might exist in 2010–2015 that should concern us. For that is about the time at which the forces we decide today to begin R&D and procurement will enter the inventory in force and when we might expect the candidate great powers to begin coming into their own.

It is worth taking a moment to consider the potential of these candidate great powers.

The EU, and its primary motivators France and Germany, is seeking to create a single defense market and to upgrade the technical capacities of the forces of the EU members states. I have no doubt that the United States and the EU (and its member states) will retain the kind of relations we have enjoyed and as allies over the past 50 years. But the products produced in Europe will be available elsewhere, a factor which we need to take into account of. It is the case that while the Soviet Union lost the Cold War, Russia was not defeated. Its scientific and military establishments may be in disarray; but their condition is no worse than in the early 1920s or the late 1930s and they have the added advantage of possessing a first class cadre of leaders in both fields. India and China are both set on a course of civil and military modernization. Both are upgrading their military capabilities selectively, with China for now taking a far broader approach than India.

All three are continental powers, possessed of large populations, interior lines of communication and are, except for India, relatively self-sufficient in many critical raw materials. All three have demonstrated a determination to play an independent role in regional and world affairs. Russia and China, and to a lesser extent India, have embarked on a course of international relations that underscores this point. And while there is no reason any of these candidate great powers should become, or should be treated today, as adversaries of the United States, it is clear that we and they have decidedly different views on issues of mutual concern.

To repeat an earlier point, our relations with these states, and others, will be formed through a combination of diplomatic, economic and military interactions. The object of this inquiry is to address the military capabilities that the United States will require to complement its foreign and economic policies in shaping an international environment dominated by a relatively large number of great powers.

As we look out over the period between now and 2010–2015 and factor in the efforts the United States is unlikely to retain any obvious advantages being made by emerging great powers as a result of its present course of military R&D and procurement. On current projections, we face a budget shortfall for the military forces recommended by the Clinton administration of the equivalent of 1–1.5 percent of GDP per year. That is, to fully fund the BUR force, to account for readiness, operations and modernization (to include R&D) would cost on the order of 4–4.5 percent of GDP. The administration is willing to budget only a little more than 3 percent; Congress seems willing to provide only a little less than 3.5 percent of GDP.

Expectations that the infusion of new technology will offset any reductions in force structure that are mandated by the lack of funding founders on the realization that current bomber designs cost between a half and one billion dollars, a new submarine up to $2.0 billion, an aircraft carrier some $3.0 billion or more and fighter aircraft between $50 million (SAST) and a quarter billion dollars each (F.22).

One might find the cost tolerable if the return where proportionately higher than in the past. But it remains the case that unit numbers of these platforms remain so low, the projected operational tempos so high to make up for a lack of numbers and the dependence on increasingly expensive "smart weapons" so great and the expectation that a prospective enemy will have no real surprises waiting for us that the chain of logic and causality leading to the conclusion that fewer, more expensive and individually more effective weapons will meet the Nation's needs in the next century is becoming more and more difficult to sustain. In the words of the scientists and engineers, we have reached the point in the relation between cost versus return—measured not in per unit effectiveness but in broad military capability—where the curve goes asymptotic. That is, we are paying a disproportional amount for the small rate of return we are receiving.

This observation is not a criticism of our scientists or military planners, Mr. Chairman. It is meant to underscore the fact that we have brought the art and means of war as they emerged from World War I and developed during World War II and the Cold War to near perfection. And if we could count on having to defend our interests and those of our allies against only "rogue" and "outlaw" states in the future who do not have at their disposal the resources of great nations and the support of allies or empires then we should be content to leave it at that.

But that does not define the likely future. Although operations against such states will undoubtedly continue to be necessary, as suggested by our discussion of emerging great powers confronting "rogue" and "outlaw" aggressors on an occasional basis does not fully define the range of the strategic interests of the Nation nor the tasks its military may be called upon to execute.

To play a strategic role in shaping the future international environment, in which great powers are likely to predominate, U.S. military capabilities will need to perform a number of highly exacting missions:

— *deter and if necessary defend against an attack on the U.S. homeland;* while this language is similar to that used at present, in fact the practical requirements will be quite different. Deterrence and defense will need to be practiced against powers, great and in some cases small, armed with strategic-range ballistic missiles, stealthy ballistic missile warheads, cruise missiles and aircraft, with access to the information nets that govern both civil society and military operations, with the ability to attack the territory of the United States, to affect U.S. space-based operations, including defensive operations, and of course able to conduct sophisticated terror operations against both civil and military facilities.

— *project military power over long distances;* U.S. forces are obliged to project their power today. The likelihood that the United States will have substantial infrastructure developed at staging areas overseas with convenient access to the theaters of combat is less certain for the future than for the past. For example, the draw down of U.S. and allied forces in Europe means that in 10 years time little will remain of the infrastructure needed to stage a major military operation in Europe. In Asia, the locus of conflict, should it occur, cannot be as easily predicted nor the routes of advance for U.S. forces plotted, as is the case in Europe. Moreover, with the elimination of bases in the Philippines and the already evident reluctance of states to grant pre-positioning options to the United States (e.g., Thailand) and the potential for Japanese demands to reduce U.S. presence on Okinawa and in Japan itself, the United States might face the prospect of sustaining major operations along the Pacific Rim from Hawaii. Even if one discounts the magnitude of the changes in the geostrategic environment suggested here, there remains as well the prospect that an adversary could possess very long range strike assets that render "near-by" bases untenable in any case.

— *sustain and protect its forces in-theater against the threats posed by an adversary.* The "strategic" capabilities an adversary might possess will certainly be fielded at the theater level. The ballistic and cruise missiles, their stealth characteristics, etc., for tactical or theater application are already in development or production. As significant as the nature of the threat is the operational requirement that will be imposed on these forces. For if the United States is operating at the end of a long logistics line with forces that are relatively few in number operating over vast distances with low force to space ratios the requirement for capabilities to find, track and destroy "in-coming" rounds even before they are fired, while they are in flight and in their terminal stages will be absolutely critical. In the future it is unlikely that mass and reserves will be available to make up for operational losses.

— *strike, when necessary, with irresistible force at the point(s) of contact at the moment of contact.* This is an extension of the "Weinberger-Powell" dicta. But its import is revealed in comparison to the Desert Storm operation. Given the lack of infrastructure and mass and reserve cited above, U.S. forces will need to begin waging war across the full spectrum of operations from the moment the operation commences. Against a substantial enemy the United States cannot afford to permit him time to organize his own forces and disrupt the deployment and employment of our own. Striking irresistibly, however, may have to be tempered by collateral damage constraints or other politically imposed constraints related to the higher objectives of the war. This means that the striking power itself needs to be discrete yet capable of "servicing" multiple targets in short intervals.

— *support the deterrent and defense efforts of our allies.* The interest of the United States is to have allies capable of operating in conjunction with the United States. The purest approach to this objective would have allies fielding U.S. equipment. This will not happen. Efforts at co-production and "inter-operability" will continue with mixed success. What is needed is a way to plug disparate force capabilities into an existing U.S. plan of battle. This plugging in needs to take place in the technical as well as operational domains. This means concentration on black boxes as well as adaptive planning tools that can perform the work-arounds necessary to create a synthetic force capable of at least coordinated if not combined operations.

— *and, do so without militarizing the polity and economy of the United States or its allies.* The growth of the civil sector in providing off-the-shelf or non-developmental items to the military suggests that this is a concern of the past. Yet, if we suppose the United States will enter a crisis or war against a great power adversary from a position that will demand mobilization then thought needs to be given to how that will be done in the first instance and how far the government can commandeer the resources of the Nation which themselves may be highly integrated. That is, to the extent we create a seamless web between the civil and military sectors in peacetime, do we not also create an imbalance in the delivery of goods and services to the public in time of war? If so, are military operations likely to be constrained as the government seeks to balance out the demands of the civil and military sectors?

A FORCE FOR THE FUTURE

The successful accomplishment of these missions in a world of multiple great powers will be a daunting task if we continue to rely on military forces configured as they are today. Again, Mr. Chairman, it needs to be noted that this is not a criticism of our current leaders and planners. It is simply to recognize that given budget realities, on our present model for structuring and posturing our military forces we will not possess sufficient resources to be able to move quickly and to sustain in a high threat environment in one, much less two or more theaters the land, air and sea forces that would be needed to defend American interests against aggression by a great power.

Reduced to its essence the problem is this: an armed force, deployed principally in the United States and based on increasingly few and expensive—albeit individually effective—platforms, will not meet the Nation's strategic needs in the early decades of the next century in light of the anticipated improvements in the capabilities of the great powers. If we are to satisfy those needs, and to perform the missions outlined above, we need to begin now to reshape our force structure and reposture our forces.

Fortunately, Mr. Chairman, we have at hand many of the technological and organizational means and methods for this task. More important still, we have recent and increasing experience with the capabilities most critical to transforming the Armed Forces—those related to the conduct and support of military operations to, in and from space.

Desert Storm has been called the first "Space War," and so it was. But in fact it merely introduced us to the potential of space operations. Americans, and most of the world, marveled at the ability of the United States to detect the launch of Scuds and to warn populations and military forces alike of their arrival, to sustain an unprecedented level of intelligence, to communicate and navigate in barren deserts, to plan and execute operations in hours instead of days, and the like, during the course of the war.

But it is worth noting that for the most part space operations played a supporting role in Desert Storm. That is, while it was possible to use space assets as telescopes and switchboards to improve the operation of forces on land, in the air and at sea, those forces operated essentially the same way as they did at the end of World War I when combined arms operations were first executed. The pace of operations, the destructive force of the weapons and the number of forces engaged in 1991 were very different, to be sure, than in 1918, but the essential limitations were the same. To provide but three examples:

— at the end of World War I the duration of a unit in combat, measured in distance against resistance, was about 4 km for infantry and 8 km for tanks; in Desert Storm the corresponding numbers were not more than 100 km for the mechanized and armored forces. What is significant here is not the difference in distance, but the source of the limitation. In both cases it was food, fuel, ammunition and the physical state of the troops and the lack of follow-on reserves.

— at the end of World War I aircraft were quite adept at spotting enemy formations and providing fire coordinates for the artillery; in Desert Storm, this was done by both air and space assets. But in both cases, the time of response—in World War I by artillery and Desert Storm by supersonic aircraft—was too slow to render the combination decisive in the conduct of the battle.

— all during World War I, but particularly at its end, it was clear that success in combat depended on logistics stocks. But this was not less true for Desert Storm. Indeed, the French, German, British and American commanders so roundly criticized for building huge stockpiles of artillery shells for example, a process that would take months and result in their expenditure in long pre-engagement bombardments were little different than their coalition counterparts who took 6 months to build up a base of supply and operation in Saudi Arabia and who began the war with a 3 week air and artillery bombardment of Iraqi positions from the front to the rear.

The point I wish to make, Mr. Chairman, is not that we have failed to make progress in the art of war since 1918; to the contrary: my argument is that with the addition of space operations to the many other technological and organizational changes that have occurred in the 20th century we have all but perfected that method of waging war.

But just as the experience of World War I brought about a fundamental change in warfare—from the 19th century reliance on straight lines and set piece battles to the modern methods of combined arms, mobility and the concentration of firepower—so too Desert Storm can mark a transition for us. Whereas the tank, airplane and wireless led the way then, space operations can do so today.

Three examples will help make the case being proposed here.

— *Surveillance, reconnaissance and targeting.* It is presently within the technical capacity of the United States to deploy a network of satellites capable of maintaining a global surveillance, reconnaissance and targeting in all weathers and at day or night and to provide this information in real-time. These technologies have been developed in both the public and private sector for both military and civilian applications. Thus far we have not fully exploited this capability. But a combination of low-earth orbit satellites, modeled on the infra-red-based Brilliant Eyes concept of the Air Force and BMD, and medium and higher orbit sensors providing data in other electro-magnetic spectra could make it possible to look for and find quickly and target in real time objects on the earth's surface, in the air or in space.

An emphasis on smaller satellites, the unit cost of which is declining as a result of the advance of technology and the increased demand for such systems by civil projects like Iridium or Globestar, makes it possible to afford the large numbers of them necessary to provide global coverage. Their small size also makes it possible to place them in orbit using launchers that are less expensive individually, require less infrastructure to support and can be made available on a schedule relevant to military commanders.

— *Offensive and defensive operations.* The ability to find and target objects in real time is justifiable only if means truly exist to exploit this capability. The work done by the SDI, now BMD, program has provided a concept for defensive operations in or to space against ballistic missile, re-entry and other vehicles transiting space in its Brilliant Pebbles, Leap and various laser programs. SDIO was in the process of completing the technical development of these concepts and entering into their testing phase when funding for these programs was substantially reduced by the Clinton administration.

Offensive concepts to, from, or in space are less well developed. Some have been proposed using hypersonic space planes or the de-orbiting of long-rod penetrators from space. But both concepts are, relative to the capacity to find and target objects and the ability of those objects to move or to take other defensive actions, far too slow. The SDI/BMD programs have developed concepts based on lasers that could perform the offensive function, particularly the Free Electron Laser. Based on the ground, it could relay its energy up through the atmosphere to mirrors in space and then back into the atmosphere. This would be a near speed of light weapon capable of striking virtually any target.

The criticism often made of space operations for offensive and defensive purposes has been their cost. But this is hardly persuasive any longer. With bombers costing up to a billion dollars each, space operations and systems become competitive for similar missions and have the advantage of real-time presence. What we need to do is to begin to consider the role of space systems for many of the functions reserved for air and sea delivered ordnance.

— *Logistics and supply.* The capacity to see, hear, talk, target and engage objects in real time would have a revolutionary effect on military operations. The ability to attack and defend, at long range, with little or no requirement for building up a local base of supply would make it possible for the kind of rapid reaction to hostilities that future wars will require without the necessity to establish a widespread infrastructure either abroad or here at home.

This is not to suggest that warfare in the future can be free of either home or forward-based forces. In the end, land, sea and air forces are needed to defend and if necessary to occupy territory. But if space operations of the kind suggested here are possible, then the character of the land, sea and air forces might be adjusted. For example, accurate, long-range, on-call fire provided by FELs might well reduce the size of the artillery park carried forward by U.S. forces. If the same fire can be provided against air and sea targets, dependence on penetrating bombers, cruise missiles, aircraft carriers, etc., might be substantially reduced. In the presence of such support, the role for infantry and armor might evolve from that hunter-killers to herders—maneuvering enemy forces into positions where they cannot resist the combined weight of space and other strike forces. The result could be much lighter and flexible forces that can be deployed more rapidly and at less cost than today's mechanized and armored force.

CONCLUSION

Mr. Chairman, I wish in conclusion to exhort the committee to explore with vigor the possibilities space operations afford to elevate U.S. military capabilities from their current emphasis on operational planning against "rogue" and "outlaw" states to one adequate to meet our strategic needs in a world of multiple great powers.

It is this Nation's good fortune to find itself with the luxury of considering carefully the future direction of its military capabilities. No great powers directly threaten the United States today. The capabilities of the forces that are in the current inventory, developed for combat against a superpower, are adequate to meet the threats posed by "rogue" and "outlaw" states for the next 10 to 15 years if they are properly maintained and provided with appropriate upgrades.

But if we have the luxury of time in making our choice, we do not have at our disposal the resources that will allow us to pursue multiple paths at the same. In fact, we will need to choose soon the path we intend to take to the future. If, in the next few years, we apply our resources to sustaining the BUR force, funding existing readiness and maintenance backlogs and begin procurement of the systems currently up for purchase—systems based on 1980s technologies at best—I fear we will place ourselves at a strategic disadvantage in the first decades of the next century.

On the other hand, if we choose to follow an approach that reduces current force structure, delays new procurement (other than for critical systems to bridge the force to the future, e.g., ballistic missile defense and strategic lift) in favor of system upgrades to existing systems and begins to invest in tomorrow's technology and forces, the United States could begin fielding by 2010–2015 a military capable of playing a strategic role in the organization and management of an international system comprised of multiple great powers. It would be a force, alone among those of the other great powers, capable of performing the full range of operations essential to success in a high-tech, high-intensity combat environment.

Such a force would provide a powerful deterrent to war, a reliable guarantor of peace, a compelling instrument in the hands of the Nation's leaders. It would mark the United States as the only great power able to conduct combat operations over the full spectrum of warfare. It would render the United States the one power each of the others would seek for an ally and seek to avoid as an adversary.

RECOMMENDATIONS

Mr. Chairman, having made a case for thinking about our Armed Forces in strategic terms and emphasizing the role that space operations can play in providing our forces with strategic leverage in the early decades of the next century, it is important to suggest steps that might be taken in this regard.

— First, our conception of "strategic" forces needs to be enlarged. We have equated strategic forces with our long-range nuclear strike forces. In so doing we have blurred the distinction between the concept of deploying military forces for the purpose of affecting an adversary's calculation and creating conditions under which, should war occur, it would be fought on terms favorable to ourselves and the instruments of warfare. It is critical that as we think about this issue we make the distinction between the two. For our task is not to find concepts that perpetuate our current weapons systems to but discover whether strategic concepts appropriate to our situation in the future require new systems.

— Second, we need to move away from our tendency to think of strategic forces as either "offensive" or "defensive." This "stovepiping" of capabilities prevents us from thinking about new ways to tackle problems. At the operational level of thinking, this stovepiping is beginning to break down. For example, the services define theater missile defense not in the narrow terms of defensive forces, but as a coordinated set of intelligence, warning, strike and active and passive defensive involving space, air, land and sea assets including DSP, F–15Es and F–18s, Patriots and Hawks, protective gear and shelters. A similar effort is underway in the context of the counterproliferation initiative. We need to start thinking in these terms at the strategic level as well.

— Third, we need to begin making organizational adjustments in the DOD and in the military command system to encourage and foster the development of new strategic concepts and applications for new weapons systems, particularly those related to space. Toward that end the DOD is to be commended for moving vigorously to implement congressional directives to create what amounts to a single point of contact in OSD/USDA&T for military space. This single point of contact will have directive authority over the Pentagon's space activity. Its authority needs to be expanded to assure that the activities of other offices and agencies operating space assets on behalf of the services and the intelligence community are coordinated with those of the Pentagon.

In the end, however, it is imperative that space operations be elevated from the status of "support" to "combat" operations. Without either offensive or defensive weapons at his disposal, the space combatant commander can bring little to the table today, of course. But this is the situation we hope to change. Therefore, USCINCSPACE, the unified commander at United States Space Command, Colorado Springs, ought to be recognized as a combatant commander and asked by the Secretary of Defense to lead an effort to define strategic concepts for the future that integrate the currently stovepiped intelligence, warning, surveillance and reconnaissance assets, offensive and defensive forces and concepts. The study should consist of two parts: the first confined to defining strategic concepts and operations broadly, per se; the second, to consider how the proposed strategic operations make possible alterations in the structure, posture and operations of our military establishment overall including the integration of warning, surveillance, strike, defense, assets, etc., and to recommend new military capabilities.

— Fourth, as an indication of the commitment of the Congress to the development of new strategic concepts and to the critical role to be played by space operations, funding should be set aside to pay for the study just outlined. But more importantly, the Congress should begin to set aside an increasing level of funding to support the development and deployment of the systems and infrastructure needed, and which the study might recommend, to make space operations a real possibility.

Three examples are worth putting forward in this context for which money and attention, not technology, are slowing progress. The first is the new expendable launch vehicle. There are at least three viable candidates for the launcher. We have dithered for more than a decade over moving forward on a new ELV. Unless we do, none of the opportunities presented by space operations can be realized. The second is a small satellite surveillance, acquisition and targeting system. BMDO's Brilliant Eyes is the most mature near-term candidate. It is presently caught up in two important but ultimately misdirected arguments regarding its role in missile defense and in early warning which have resulted in its not being funded robustly. The fact is it can do both—and more. What we need to do is to get it, or something very much like it, flying soon and in numbers—about 12—that will help us discover the potentials and shortfalls of small satellites for a variety of military missions. The third example is advanced weapons concepts. The free electron laser was cited earlier; other candidates might be a space-based laser, a neutral particle beam, electromagnetic generators, and so on. There is no lack of imagination and technical progress in these advanced concepts areas. What they suffer from is a lack of funding and, frankly, supervision.

— Fifth, we need to integrate the capabilities of our civil and military space sectors. In this regard it is important to be clear that this is not a recommendation to abolish the distinction between civil and military programs. Rather it recognizes that operations in space are expensive and that the data collected or communications capabilities provided by civil and military satellites can be useful to both communities. Thus, encouragement needs to be given to steps already under way at USSPACECOM and in other places to establish the protocols that will permit easy sharing of data and system capabilities between the communities. In addition, the military, at least, needs additional funding to develop the computational and communications support needed to exploit this rich data pool at the level of the soldier, sailor and airmen.

Mr. Chairman, these recommendations in themselves are not radical nor do they require overwhelming increases in defense spending. Of those put forward only the new ELV requires substantial funding increases in the next few years. But that is because it is one of a small number of critical path items necessary to achieve the goal of new strategic concepts and space operations. As for the rest, they are meant to serve both as examples of efforts already underway in the space and military community and recommendations for action which, if given focus and reasonable funding, can help lead the way to a strategic force for the 21st century.

Senator LOTT. Thank you, Dr. Cambone. Dr. Pace.

STATEMENT OF DR. SCOTT PACE, POLICY ANALYST, CRITICAL TECHNOLOGIES INSTITUTE, THE RAND CORPORATION

Dr. PACE. Thank you, sir. Thank you very much for the opportunity to talk to you today.

My background is not only at the RAND Corporation, but also prior to that with the Department of Commerce where I have been involved in commercial space activities, as well as military space issues at RAND.

I guess my perspective is that if the United States is going to remain a military and an economic super power in the next century, that space and particularly military and economic aspects of space are going to play a big role in that super power capability.

I think it is important, as we are talking about military space in general, that we realize it is only one part of national U.S. power in this area, that we have obviously a strong civil space program. It is about $14 billion; with a military space program on the order of $15 billion. We have a growing commercial space sector on the order of $6.5 billion.

But the important thing that is different about the commercial space program is that it is growing and it has been growing at an average rate of about 20 percent a year, mostly information based technologies, communications, a little bit of remote sensing, GPS being a big part of that growth, whereas the Federal component of that, civil and military space, has been flat or declining. So, it does not take much to realize that as you get out an extra 5 years, 10 years, as commercial space keeps growing, a greater and greater proportion of U.S. national power in space will reside with the commercial space community, where a lot of the technology is going to come from and where a lot of the industrial base is going to be dependent.

But this is coming at a time when not only is the complexion of space itself changing, but that the emphasis that is happening on military space is also changing. It is coming out from the dark world, from a focus on strategic, nuclear, and intelligence matters and has been focusing more on the needs for the conventional warfighter, that is, you are trying to satisfy a number of different diverse customers.

So, there are incredible changes that are happening in the military space community right now, and it is putting a lot of stresses on the system. One of the things that you naturally see is that debates about military doctrine, joint service roles, who does what, what missions they serve, those kinds of debates that happen with other parts of the force structure are starting to happen in space. In part, that is a positive development because that is showing that space is becoming more of an integrated part of mainstream military forces. That I submit is one of the continuing challenges that military space is going to have at least in the next 10, 20 years, is how it integrates and becomes part of the mainstream military rather than being something that is separate and off in a corner.

One of the other things that is characteristic about space activity today is that many of military space activities have strong commercial counterparts. Now, some things like integrated threat and warning attack assessment and so forth are purely military functions, space control, missile defense, purely military functions. But a lot of the rest of what you see, everything from environmental to remote sensing, to GPS, space launch, all have a civil or commercial counterpart to it. Therefore, the strength and health of the commercial and civil community is vitally important to this country, vitally important to our military capabilities, as well as our economic capabilities.

When looking at the range of activities that the United States is involved in, on the information side of the equation, the United States is doing very well. On the launch vehicle side of the equation, the United States is doing very poorly.

I had one experience, when at the Department of Commerce, where we visited a country that was looking at developing its own launch vehicle. We were trying to convince them that it was a poor idea for them to develop this launch vehicle because of the resultant proliferation activities. They insisted they were doing it for commercial purposes.

So, one of the things that we did was to show them through a business analysis that this would lose money for them. They would not make a dime. They eventually agreed that they would not make any money on it. Therefore, they decided to stop the program.

That was a very positive development, but the disturbing part about it was that they were not afraid of the United States. They were not afraid of competition with the United States. They saw U.S. weakness in launch vehicles as, in fact, a market opportunity for them to enter.

Senator EXON. Excuse me, please. Mr. Chairman, may I enter my statement in the record and some questions for the record?

Senator LOTT. You certainly may.

[The prepared statement of Senator Exon follows:]

PREPARED STATEMENT OF SENATOR J. JAMES EXON

Thank you, Mr. Chairman. In my opening statement for the first panel, I commented on the parochial nature of the individual military service space programs, and the obstacles that has posed for trying to develop more "jointness" in everything from the determining of requirements to the development and operation of space systems. The prepared statements of our first panel certainly showed that parochialism full well. The Navy witness talked about Navy systems and Navy priorities, and only mentioned the potential contributions of the other services in the context of not subordinating the Navy. The Air Force witness, by contrast, is all for centralizing responsibility and authority for space programs, so long as it's under the Air Force.

Mr. Chairman, this committee has lived through a period in which the Navy developed, launched and used its own Fleetsat communications satellites, while the Air Force, not to be outdone, had its own AF–SAT–COMs for Air Force use. Mr. Chairman, this is not a partisan issue—the problem has persisted under both Republican and Democratic administrations. We have to find a way to insist on the development of greater "jointness" in the exploitation of space systems. I join you in welcoming our second panel of expert witnesses this morning, and I look forward to their testimony. I hope they can shed greater light on what we can do to promote further "jointness."

Senator LOTT. Also, I have some questions I would like to ask. I want to thank these witnesses both for being here. I profoundly apologize for the interruption, but ordinarily we would go vote and come back, but we are going to have a number of votes in a row. So, I will submit my questions for the record, and I would like to get your responses to these questions on the record so that this will be available to us as we move forward and start making decisions in this area.

I have about 2 more minutes and then I am going to have to go. If you could conclude your remarks in the next couple of minutes.

Dr. PACE. I will simply conclude that the most important thing that we can do, I think, in military space is to look for greater cooperation with the commercial sector.

The most important policy change that we could make, the most important function we could do is to bring back the National Space Council which, I think, performed a very useful role in integrating civil, military, and commercial interests in the last administration. I think the lack of a National Space Council has been an unfortunate occurrence, and I would like to see that rectified.

Thank you.

[The prepared statement of Dr. Pace follows:]

PREPARED STATEMENT BY DR. SCOTT PACE, POLICY ANALYST, CRITICAL TECHNOLOGIES INSTITUTE, THE RAND CORPORATION

Mr. Chairman, members of the subcommittee: I would like to thank you, Mr. Chairman, and the other members of the Subcommittee on Strategic Forces for providing this opportunity to address you today. This is a time of great uncertainty and challenge for U.S. and international space activities and these hearings are particularly timely in addressing military space activities in a post-Cold War environment. To the extent the United States is and will remain a military and economic superpower in the next century, the United States must remain a military and economic superpower in space.

My perspectives on U.S. military space power have been shaped by experiences as an engineer in the aerospace industry, service in the Office of Space Commerce at the U.S. Department of Commerce, and an analyst at RAND. Space activities tend to cut across traditional boundary lines of national security, foreign policy, and economic policy and thus present serious organizational and management questions as well as technological challenges. I hope to highlight what I see as the most important long-term issues in military space, with the caveat that these are my personal views and are not necessarily those of RAND or its sponsors.

MILITARY SPACE IS BUT ONE SECTOR OF U.S. SPACE ACTIVITY

U.S. space activities consist of four distinct, but interrelated sectors: civil, commercial, military, and intelligence. Civil activities include those of NASA and the National Oceanic and Atmospheric Administration (NOAA). Commercial activities are exemplified by private communication satellites, but also include launch services, remote sensing data, and the growing market for Global Positioning System (GPS) navigation equipment. Other witnesses today have ably described current U.S. military space programs and we cannot, of course, address intelligence matters in this present forum.

At present, the annual NASA budget is about $14.5 billion, reported military space activities are about $15.1 billion, and commercial space revenues are estimated to be $6.5 billion.[1] Total commercial space revenues have been growing at an average of 20 percent per year for the last 5 years, some years being better than others. In contrast, U.S. Government space spending will stay flat at best in constant dollars and will more likely decline. This is certainly true of NASA and may be true for the Department of Defense as well. What this means is that commercial space revenues from communications, remote sensing, and satellite navigation will increase in importance. At current growth rates, commercial space will account for 40 percent of U.S. space spending in the year 2000—5 years away. If the growth rate drops in half, to 10 percent per year, commercial space will still account for 28 percent of U.S. space spending. (See Figure 1.)

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[1] Library of Congress, *Military Space Programs: Issues for the 104th Congress,* Marcia S. Smith, Congressional Research Service, 95–95 SPR, January 11, 1995; U.S. Department of Commerce/International Trade Administration, *U.S. Industrial Outlook, Chapter 28—Space Commerce,* U.S. Government Printing Office, Washington, D.C., January 1994.

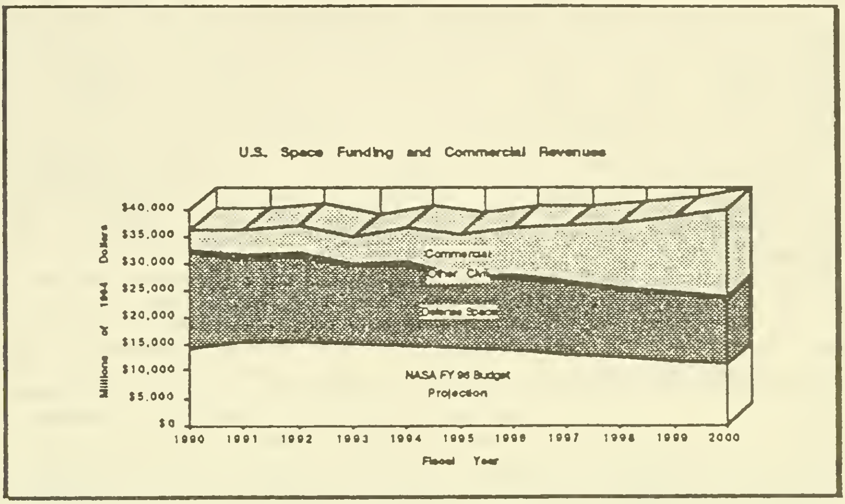

Figure 1

NEW OPPORTUNITIES AND CHALLENGES FOR MILITARY SPACE POWER

In parallel with the changing mix of U.S. space activities, space operations are being driven by new pressures from a dynamic international security environment, changing national security priorities, and organizational and doctrinal debates within the U.S. military and intelligence communities. The end of the Cold War has marked a new period of uncertainty in threats, policy and programs, an overall downsizing of military forces, and a growing linkage between military and economic security interests. The space industrial base has not been exempt from declining procurements and in some areas of advanced space systems, it has been hit harder than most.[2] As a result, U.S. space industries are seeking commercial markets and emphasizing technologies driven by consumer demands. Domestic economic pressures and the lack of a national vision for space activities are calling into question the whole structure of U.S. national security space activities, but as yet no answers have emerged.

The world of military space systems is shifting from its traditional focus on strategic nuclear and intelligence matters to supporting the needs of the warfighter. Nuclear and intelligence matters are still of paramount importance in setting requirements for space systems, but the emphasis is changing from the deterrence of nuclear conflict with the Soviet Union and the gathering of information from denied areas to one of meeting the needs of conventional (and special) force commanders. U.S. military forces are increasingly involved in crises and other conflicts, such as humanitarian operations, disaster relief, air zone monitoring, and protection of U.S. citizens overseas. The same pressures facing U.S. forces in supporting national interests also affect military space forces and will make the necessity of integrating space with conventional operations all the more urgent.

Operation Desert Storm demonstrated the ability of space systems to contribute to the lethality of U.S. forces and their sustainment in the field. Logistics were managed over satellite communication networks. Scud launches were detected by the Defense Support Program and warnings relayed to theater commanders. GPS receivers guided tanks and troops across the open desert. Commercial and national remote sensing systems provided data for mission planning of air and ground forces. Civil and military weather satellite data were a part of every pre-mission briefing.

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[2] Vice President's Space Policy Advisory Board, *The Future of the U.S. Space Industrial Base,* Washington, D.C., November 1992.

Civil, commercial, and international space activities are becoming increasingly important in the conduct of military operations. While the Persian Gulf war highlighted the importance of space power in supporting conventional military operations, future joint operations will demand an expanding role for space forces that also support economic security objectives. Warfighters, users, and military planners must be concerned with the implications on future military operations of facing adversaries having significant space capabilities or with access to space-derived data products. In this dynamic security and budgetary environment, it is incumbent upon members of the military space community to determine even more carefully which space forces and operational arrangements are needed, when they are needed, and by whom, and what the operational implications are of the space force structure that results. To do this effectively and realistically, they will need to enlist the extensive knowledge and experience of the civil and commercial space communities, since there are likely to be not only advanced technologies under development of relevance to military space operations but also alternative standards, procedures, and practices that may be constructively applied by the military.

To the extent that some commercial technologies are superior to or more readily available than military counterparts, the effectiveness of U.S. forces can be improved (e.g., as has been the case in the use of personal computers). A more subtle reason is the use of economic forces to shape the future environment—in other words, "shaping the battlefield" in which U.S. forces operate. For example, to the extent that the United States could lead in providing commercial satellite communications, remote sensing, satellite based navigation, and space launch services, it would be in a better position to benefit from those national capabilities in wartime. To the extent the United States cannot peacefully influence how and when those capabilities are provided, it may have to escalate the use of military force to protect its interests. In terms borrowed from strategic deterrence theory, economic power in dual-use capabilities provides additional escalation options to the National Command Authorities (NCA) without requiring additional force structure.

In many respects, the demands on military space power have grown more complex since the end of the Cold War. In addition to serving the National Command Authority, as they always have, today's military space systems must serve a diverse warfighting community that may fight anywhere in the world, at any time, and at widely varying levels of conflict.

MANY MILITARY SPACE FUNCTIONS HAVE COMMERCIAL COUNTERPARTS

Some space activities have purely military functions. Examples include integrated threat warning and attack assessment (ITW/AA) such as that provided by the Defense Support Program and the nuclear detonation detectors aboard GPS satellites. I might add that the GPS-based detectors are not only a unique military resource, but vital to nuclear arms control and proliferation agreements. In the future, other military functions may include ballistic missile defense and enhanced means of exercising space control. Many other space activities, however, are driven by commercial and civil interests along a spectrum that spans all space sectors. (See Figure 2.)

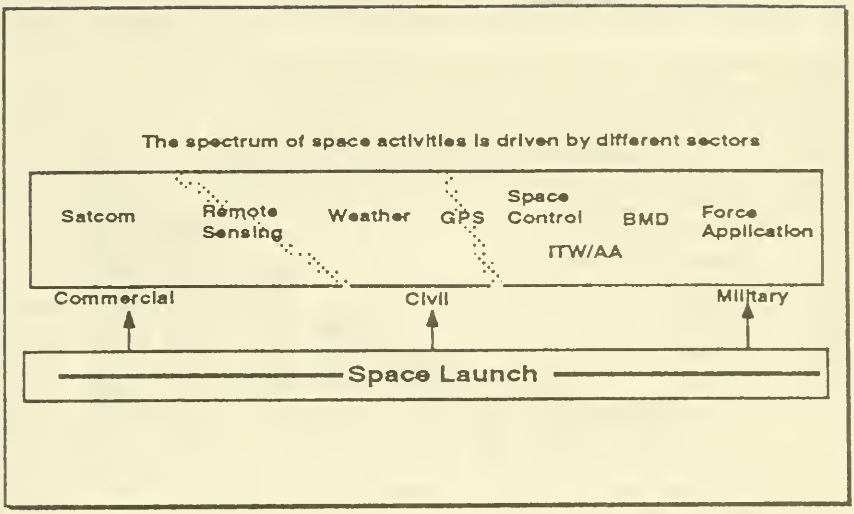

Figure 2

The steady growth of the commercial space sector presents both opportunities and challenges to the military space community. Unlike the functions performed by traditional weapons systems, such as fighters, bombers, tanks, and warships, the functions performed by military space systems often have direct commercial counterparts. This should not be surprising since civilian and military space systems all typically involve the acquisition, management, and distribution of information. In addition, all space sectors rely on launch vehicles for access to space. Space technology is thus commonly termed "dual-use" in that it has both military and civilian value.

We are all familiar with cellular phones and their limitations. Soon seamless mobile phone service will be available on a national and international scale as a result of commercial space ventures such as American Mobile Satellite and Iridium. Commercial space-based communications are being driven by new information technologies and markets more than any current government program or requirement. U.S. forces have a particular need to communicate from places where fiber optic lines cannot or will not go and thus may take a special interest in these new space services.

One of the most spectacular results of military R&D investment since the Internet is that of the Global Positioning System. GPS is a system of 24 satellites in high earth orbit, halfway to the geosynchronous orbit used by communication satellites. They provide precise time signals worldwide which can be used for navigation, position location, as well as precision timing (e.g., synchronizing long-distance communication and computer networks). Commercial sales of GPS equipment have risen steadily as prices for them have fallen. Today, military purchases are a small and declining part of total sales. (See Figure 3.)

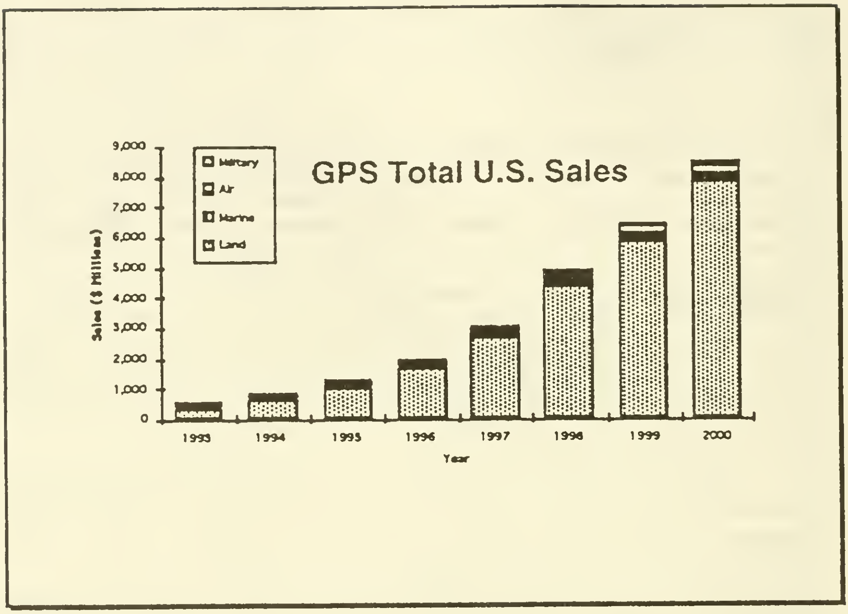

Figure 3

Up-to-date remote sensing data are in demand for geographic information systems, environmental assessments, and military planning. U.S. commercial remote sensing systems such as Earth Watch, Space Imaging, and Eyeglass are seeking to compete with foreign systems developed in Russia, France, and Israel. If the U.S. fails to compete effectively and thus influence the shape of these new markets, the loss will harm both the U.S. economy and national security. The United States could find itself dependent on foreign remote sensing data suppliers who may not share U.S. security objectives in a particular conflict.

The positive commercial developments in communications, remote sensing, and navigation are not replicated in space transportation. Current U.S. launch vehicles are labor intensive, costly, and not as responsive as required by all space sectors. U.S. launch providers have lost dominant market share to the European consortium, Arianespace, and are facing newer competition from China and Russia. The latter competitors are particularly troubling as they are still in transition to being market-based economies and have the capability to price as necessary to win. While Arianespace prices are subject to market disciplines, steady government support for upgrading its launchers have enhanced European competitiveness. U.S. firms have also invested heavily to stay competitive, but there is only so much that can be done with vehicles essentially derived from 30-year-old ICBM designs.

NASA is proceeding with experimental X-vehicles to demonstrate reusable single-stage and two-stage-to-orbit concepts. The DOD is seeking to upgrade current launchers through its evolved expendable launch vehicle (EELV) program. High space transportation operating costs are a continuing burden on all U.S. space activities and the NASA efforts are still very experimental. In addition to economic costs, a weak U.S. competitive position creates an incentive for the entry of new launch vehicle suppliers and the spread of ballistic missile technology. Countries seeking their own ballistic missiles have been tempted to offset development costs by offering "commercial" launch services. A competitive U.S. launch industry could help provide an economic deterrence to missile proliferation as well as more effectively support military needs for space access.

FUTURE DIRECTIONS FOR U.S. MILITARY SPACE POWER

The purpose of military space systems are the same as other military systems for which the United States spends billions of dollars. As part of providing for the common defense, military space systems protect national security interests by enabling the United States to deter aggression and prevail on favorable terms if deterrence should fail. Space systems enhance the power projection capabilities, lethality, and efficiency of U.S. forces.

The growth of civilian space systems provide opportunities to enhance national space power, in addition to military space power. Not only do such systems augment U.S. capabilities, they can also stimulate technology investments that the DOD would otherwise be unable to afford. Through cooperation between the commercial and national security communities, the United States may be able to exercise some influence on the development of global space systems and thereby shape the future order of battle in military space. It has been a truism that U.S. national security and economic security are linked, but the dual-use nature of space systems makes that linkage particularly tangible.

In the near term, the central challenge for military space is how to best integrate with mainstream military forces and support the warfighter more effectively. This has inevitably brought military space into the middle of debates over doctrine, organizational turf, and service roles and responsibilities. This should be expected as a natural result of space becoming a part of conventional military warfighting. In the longer term, the U.S. military will likely find space just as important an area of combat as the air, sea, and land are today. The U.S. economy and U.S. forces are dependent on space, and it is becoming increasingly important that the United States prevent the misuse or denial of space systems and access to space.

Theater missile and ballistic missile defenses are obvious next steps for operational military space systems. The spread of weapons of mass destruction, the difficult threat posed by cruise missiles, and continuing international instability all argue for enhanced defenses as a prudent precaution. Of course, the creation of these new capabilities requires hard decisions in the Defense budget. As a first step, greater efforts should be made to determine joint requirements for such defenses and what can be done using current technology.

Beyond missile defenses, the development of military space will follow the path of U.S. interests in space exploration and development. If relatively cheap access to space becomes a reality, there may be even faster growth of commercial space industries, including space-based industrial facilities and living quarters. The Clementine mission by BMDO has provided the first scientific indications that there may be water at the south pole of the Moon. If this is true, estimates for the cost of a permanently inhabited lunar base would drop considerably. To the extent the United States finds it has vital national interests in space, it should seek to develop a military space capability commensurate with protecting those interests within the boundaries of international law. If an independent space service does become desirable, it will have many historical models in the American frontier tradition of using military forces for exploration and the protection of scientific and commercial expeditions. If the United States does not extend permanent human activity deeper into space, however, it is unlikely that there will ever be a need for an independent space service.

UNCERTAINTIES FOR U.S. MILITARY PLANNERS

There are a number of uncertainties for U.S. military planners that will shape the environment in which operational and organizational changes will occur. These uncertainties range from policy and budget uncertainties, to operational uncertainties including an uncertain threat environment and the coordination of military and non-DOD space activities, and the integration of U.S. economic and military space interests.

POLICY UNCERTAINTIES

There does not appear to be a coherent, consistent process in place to adjudicate among planners and users of space forces and policymakers. Like national security policy, U.S. space policy formulation and implementation have become an arena for agencies and entities other than those traditionally associated with space programs, i.e., NASA, the DOD, and Congress. Unlike national security policy, however, space policy does not have a defined structure dominated by a select group of agencies. Space policy encompasses both a wide variety of topics, ranging from technology to operations to economic considerations, and a large number of interested Federal departments, agencies and congressional committees. There is no longer a single established forum for debating military and civil space issues from an interagency perspective.

BUDGETARY UNCERTAINTIES

Aside from surprising dynamic changes in the threat environment, the most important uncertainty is the size of the DOD budget over time. Resource constraints are an important issue not only for specific programs, but for the priorities established by the services, DOD, and the civilian leadership. If defense and service budgets continue to decline as they have done recently, strong pressure will be exerted within each service to support its "core competencies" and divest itself of those functions and activities not considered central to its being. The current situation where the services feel strong downward pressure on their budgets is made more difficult by the feeling that the decline has not "bottomed-out" yet. The lack of a stable economic floor (or ceiling) makes long range planning for space forces and consequent civil-military relations very uncertain.

OPERATIONAL UNCERTAINTIES: SPACE FORCE INTEGRATION INTO MAINSTREAM MILITARY OPERATIONS

The next major uncertainty is how space forces are (or will be) integrated into "mainstream" military operations. There continue to be many doctrinal, institutional, and operational barriers to utilizing space forces in combat operations. Doctrinal barriers are exemplified by the lack of a joint doctrine for military space operations and a mutual understanding of how the principles of war apply to using information systems not associated with direct combat.[3] Institutional problems include the reluctance of commanders to depend on systems they do not command, whether government or private, and the traditional problems of joint operations that occur when the same space forces serve multiple CINCs (such as prioritization of access).

OPERATIONAL UNCERTAINTIES: COORDINATION OF NON-DOD SPACE ACTIVITIES

Ensuring the effective coordination of non-DOD space assets, especially commercial and intelligence assets, military planners face uncertainties that are similar to those encountered in planning joint operations. In using commercial space assets to support a conflict, there will be political sensitivities to using assets that may be controlled but not commanded by the military. This may increase the risk of interference by more senior commanders or civilian political leaders if private assets are not handled in the most legal and sensitive manner consistent with clear military necessity. Military planners may seek to create a single command for space forces, but they will face competition from individual service components for the control of specific commercial assets unless prearranged plans are in place. Perhaps most important, it is unlikely that commercial assets (such as communications, remote sensing, or civil GPS augmentations) will be employed effectively unless peacetime exercises incorporate them.

UNCERTAINTIES IN THE INTEGRATION OF U.S. ECONOMIC AND MILITARY SPACE INTERESTS

For the future, uncertainties in the integration of U.S. economic and military space interests are also driven by competition in the global marketplace. Commercial space competitiveness for the immediate future can be divided into two general areas, space launch and space-based information systems. In space launch, the United States is doing poorly and facing increasing international competition. At the same time, the United States has yet to make tangible progress on a new generation of launch vehicles that will break with the ICBM heritage. In information systems, the United States is very competitive and arguably the most efficient, advanced manufacturer of satellite systems in the world, although the gap with other countries is closing for many components and subsystems. If the United States regains world leadership in space launch, it can exploit its satellite expertise and contribute to U.S. military power. If the United States fails to regain a dominant position in space launch, then the U.S. lead in information systems will be at greater risk as other nations gain technical skills. This in turn may mean that DOD will have to expend greater effort to ensure it retains a dominant position in military space forces without a strong U.S. commercial space sector.

CONCLUDING OBSERVATIONS

The future of military space power requires paying attention to the dynamics of commercial and international space activity in order to gain technological advantages, promote U.S. leadership, and shape the international environment in ways that protect (or at least do not threaten) U.S. national interests. The degree to which U.S. commercial space firms are internationally competitive will likely drive U.S. national space capabilities and technologies. Even in a period of fiscal constraint, it is possible to enhance the effectiveness of U.S. military space capabilities through cooperation with civil and commercial sector interests.

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[3] Joint Publication 3–14, *Joint Doctrine: Tactics, Techniques, and Procedures (TTP) for Space Operations,* was due to be published in June 1994 but has not yet been released.

Military space power does not consist of just a catalog of individual space system capabilities, but how those systems are integrated for deterrence and conflict. Civil and commercial systems are also an integral part of a nation's space capabilities. This means that the DOD should seek to exercise and train with non-DOD space systems to ensure it can effectively use their capabilities in an emergency. This includes the use of communication and remote sensing satellite systems, as well as commercial launch services. One can imagine a "Civil Reserve Space Fleet" modeled after the Civil Reserve Air Fleet (CRAF). Similarly, excess capacity on the Air Force Satellite Control Network (AFSCN) could be made available to commercial remote sensing ventures licensed by the U.S. Department of Commerce. Exercising and training with civil and commercial space systems might also be extended to allied nations on a case-by-case basis. As a general matter, the DOD should seek to cooperate with commercial space firms and enhance their ability to compete with foreign space interests.

Improving space launch should be a high priority for both immediate military needs and the longer term benefit of U.S. national power. The most important investments the DOD can make in new space technologies is the radical reduction of launch costs. As a minimum, the DOD should ensure that it is capable of state-of-the-art work in reusable launch technology and can incorporate lessons learned from NASA efforts. Spacecraft themselves contribute as more or more to the cost of space systems in comparison to launch vehicles, but the high cost of access to space continues to make innovation in spacecraft manufacturing difficult. With access to space being expensive, it is hard to qualify and demonstrate new, lower cost technologies for use in space even if they are already available on the ground. The United States will be hard pressed to maintain a robust military space capability without a strong, commercially-driven, space industrial base that includes world-class launch services.

Space activities tend to create interdisciplinary policy issues that involve mixtures of national security, foreign policy, and economic interests. From my own experiences at the Department of Commerce, the National Space Council provided an effective interagency mechanism for balancing these interests and defining administration policy. There is no substitute for having agency representatives work directly together, sometimes for months if need be, to improve their common understanding of U.S. interests in space. It is sometimes objected that there is no point in having a Space Council if the President does not personally care about space. That objection is being overtaken by events. Space is no longer an optional activity for international prestige, but a vital element of U.S. power and policy. As such, space has a permanent place on the national agenda and the primary question is how well space policy issues will be managed, not whether they will arise.

Senator LOTT. Thank you again, and my apologies again. Next time I think we may begin with the outside witnesses and save the military for last. Thank you very much.

This hearing is adjourned.

[Questions for the record with answers supplied follow:]

QUESTIONS SUBMITTED BY SENATOR TRENT LOTT

MERGE SPACE ACQUISITION MANAGEMENT

Senator LOTT. General Dickman, some have advocated a virtual merger of the Department of Defense and the National Reconnaissance Office space acquisition management. This seems to be what Deputy Secretary Deutch was advocating in his recent confirmation hearing to be Director of Central Intelligence. Would you support such a merger? If so, what structural and procedural changes would you recommend in order to achieve this?

General DICKMAN. Since the Air Force is only one of many players in space, any discussions on mergers should be held between all stakeholders. However, I certainly endorse increased cooperation between the Department of Defense and the intelligence community, particularly in the space planning area. Further, I believe it is possible to build a management approach that would put one individual overseeing the Department of Defense and the National Reconnaissance Office space acquisition, while preserving the essential equities of both organizations.

From an Air Force perspective, we are seeking new and better ways to work closely with the intelligence community. For example, we have programs underway in the space launch and infrared sensing areas that serve as leading examples of improved cooperation. The intelligence community will be a principle user of the Evolved Expendable Launch Vehicle (EELV). For infrared sensing, the Space-Based InfraRed System (SBIRS) program featured unprecedented integration of Department of Defense and intelligence community requirements focusing on the full spectrum of military requirements for missile warning and missile defense, and national requirements for technical intelligence collection.

In addition, the Air Force has the lead to consolidate space architecture planning across the Department of Defense. Plans are well underway for a Department of Defense Space Architect and may evolve in the future to consolidate intelligence space architecture planning functions in a National Security Space Architect.

SPACE INFRASTRUCTURE

Senator LOTT. General Dickman, the Air Force has almost 40,000 people assigned to space-related duty and maintains a large and costly space infrastructure. What is being done to consolidate and economize in these areas?

General DICKMAN. Air Force Space Command has 26,900 Department of Defense personnel authorized and employs approximately 11,108 civilian contractors. 10,900 of the Department of Defense authorizations are not assigned to space related duties; they are assigned to intercontinental ballistic missile related duties. Also, a large number of the civilian contractor force are not assigned to space related duties but provide services such as transportation, base support and airfield operations, etc.

The Air Force has made space infrastructure modernization a top priority and we expect to gain efficiencies through programs such as Evolved Expendable Launch Vehicle (EELV) and Range Standardization and Automation (RSA), both aimed at making the space mission more affordable. The primary goal of EELV is to reduce costs while providing assured access to space through increased production rates, by using fewer launch pads, reduced manpower and space launch infrastructure. RSA replaces old (1950s, 1960s and 1970s), one-of-a-kind equipment, which has become costly to maintain and support, with newer standardized technology. Benefits will be from cost avoidance and through facility consolidation. Additionally, multiple force structure adjustments, such as base realignment and closure actions, are in progress or in the planning stages. Finally, several launch facilities on both coasts are being closed or are planned to be closed or mothballed, while other facilities such as Space Launch Complex No. 6 at Vandenberg AFB have been leased to commercial entities.

In addition to these operational initiatives, we have embarked on a major streamlining of the space acquisition process. We are optimistic there will be significant manpower and cost reductions, both within the Department and in contractor overhead.

COMMERCIAL SPACE SYSTEMS

Senator LOTT. General Dickman, Congress has repeatedly urged the Department of Defense to make greater use of commercial practices and systems to satisfy space-related requirements. What is being done in response to this guidance; what more, in your view, can be done?

General DICKMAN. We have numerous examples in the space acquisition business. Let me highlight just a few.

Our primary target for commercialization initiatives are new programs like the Evolved Expendable Launch Vehicle (EELV). EELV encourages industry to examine both commercial and government practices and to propose the practices that provide the most value. Although military specs and standards are not required, industry is free to use them if they choose.

We also recently released the Atlas IIA/IIAS Launch Vehicle request for proposal which reduced the number of mil-specs and standards from 350 down to 28. This effort uses contractor specifications for the procurement of commercial launch services instead of the old method of buying hardware. In addition, our Titan contract is removing over 100 mil-specs and standards on its launch operations follow-on contract and will be awarded in fiscal year 1996. The Range Standardization & Automation (RSA) Phase IIA contract has only four mil-specs.

Our space acquisition business is also using commercial off-the-shelf (COTS) software and hardware for several of our efforts such as the Delta II Advanced Launch

Control System and the upgrade to Space Command's Cheyenne Mountain Complex. At the same time, our Inertial Upper Stage Avionics activity is using a COTS laser-ring gyro that is used in commercial aircraft.

I believe the acquisition of the next generation MILSATCOM systems will have great use of commercial practices—more than anything we have done in the past.

MILSTAR

Senator LOTT. General Dickman, legislation has been introduced in the Senate that would curtail our acquisition of Milstar II satellites and accelerate the so-called Advanced EHF program. What would be the impact of canceling Milstar 5 and 6? Is it even technically feasible to have Advanced EHF satellites built and ready for launch in time to substitute for these?

General DICKMAN. During the 1993 Bottom-Up Review the Department evaluated this very option. The review team, which included members from within and outside the Department of Defense, unanimously concluded that the defined program (2 Milstar Is, 4 Milstar IIs and then an Advanced EHF follow-on) "represent[ed] the best means of achieving the needed communications capabilities in the near term while potentially reducing the long term costs associated with sustaining this capability."

Since then, the first Milstar I satellite was deployed and used operationally in support of Operation Restore Democracy. The second will be launched this fall. The Medium Data Rate payload, the heart of the Milstar II system, passed its critical design review, and over 90 percent of the non-recurring work on that payload has been completed. And finally, the Air Force placed on contract the last two satellites in the series.

The alternative program directed by the bill (accelerating Advanced EHF) was judged as high risk by the BUR Military Satellite Communications task force and that is still the case. Even under the most optimistic assumptions, the Accelerated EHF program could not be ready for launch in time to substitute for Milstar 5 and 6. Given that nearly 2 years have passed since that review, the option is even less feasible.

Also, deletion of the last two Milstar II satellites will not yield significant savings. Any savings will largely be negated by the cost to accelerate development of the follow on EHF capability and the sunk costs for Milstar. We have initiated parts procurement and fabrication for Milstar Satellites 5 and 6 and would incur costs to terminate as well as for any work effort expended. Assuming a termination of Milstar Satellites 5 and 6 in late fiscal year 1995, costs incurred would be approximately $130 million.

EHF SATELLITE PROGRAM

Senator LOTT. General Dickman, when we talk about an advanced EHF system, basically we mean one that is small enough to be launched on a medium launch vehicle. But to get on an MLV in time to replace Milstar, there is a chance that certain Milstar capabilities would have to be omitted, such as on-board processing and crosslinking. In this sense, an Advanced EHF system may be less capable than Milstar. All this seems to be driven by the high cost of heavy launch vehicles. But if you succeed with your ELV program, heavy launch, does it make sense to start a program before we have a better idea how much heavy and medium launch will cost in the future?

General DICKMAN. No, we are not ready to begin a program to build an advanced EHF satellite. Right now we are investing in technology that will allow us to field a system that uses less power and weighs less. The EHF system is one of many users of the planned EELV capability. As we transition the EHF program into EMD later this decade, we will have a better idea of how much heavy and medium launch will cost for satellite programs to be launched on EELV. At that time we will make specific capability decisions for the EHF system and define an upper weight limit based on the boosters that will be available.

SPACE LAUNCH

Senator LOTT. General Dickman, to date we have demonstrated a pretty poor record on fixing our space launch problem. Some have even concluded that the United States is incapable of solving its launch problems. What makes your EELV program different? What sort of confidence do you have that this time we are on the right track?

General DICKMAN. The "problem" in space launch is cost; in many ways, U.S. space launch is the world standard. Our systems have the best performance and reliability anywhere, and our schedule performance over the past 2 years, especially for medium launch, has been very good.

We are confident the EELV program is the right strategy. The EELV is different in many ways from previous programs. It is a clearly focused program managed by a single government agency (the Air Force), with all government and industry interests fully coordinated. The absolute consensus is that reducing the cost of space launch is the fundamental goal. The requirements have been carefully scrubbed and are scheduled to be validated this summer. My biggest source of confidence is the strong commercial involvement in the program.

EELV PROGRAM

Senator LOTT. General Dickman, a number of American companies who are likely to be players in the EELV program are interested in using Russian designed engines. What would be the advantage to using such engines? Do you support their use; if so, under what conditions?

General DICKMAN. The primary advantage is a lower cost engine, with little or no development cost, with an equivalent or better performance. We support lower cost options, so long as the risk of a foreign source does not jeopardize our national security needs for space launch. The conditions we require are set forth in the Department of Defense Policy directive on the use of Russian Rocket Engines, which will be delivered to Congress later this month. Specific direction in this policy includes the requirement for U.S. industry to have adequate engineering capability to resolve anomalies, to have contingency plans in the event the source is denied in the near term, and to produce the engines in the United States 4 years after engineering and manufacturing development begins on these engines.

ACCELERATE LOW ORBIT

Senator LOTT. General Dickman, it made a lot of sense to conduct a comprehensive assessment of our infrared warning and tracking satellite systems and to consolidate these efforts and their supporting ground segments. But I remain concerned that the scheduled first launch for the low orbit segment (formerly known as Brilliant Eyes) is 4 years behind the high orbit segment. My understanding is that the Air Force believes that we could accelerate the low orbit segment by up to 3 years within the limits of acceptable risk, and that when we get data from the flight demonstration system we might be able to accelerate this even more. Is this true?

General DICKMAN. The Space Based InfraRed System (SBIRS) program is a direct result of the Space Based Sensor (SBS) study performed last summer. Given the available funding, the current requirements and threat, and after considering the risk, a baseline deployment date of fiscal year 2006 for the Low component was planned.

It is, however, possible for the Low component of SBIRS to deploy sooner. The technical risk of the program would grow somewhat, but stay within acceptable risk limits. Based on what we know today, the first operational satellite of the Low component could be launched in fiscal year 2003. This would require increases in the planned budget beginning in fiscal year 1999. Once the flight demonstration system program is complete, we will have a more complete picture and might be able to accelerate the deployment date for the SBIRS Low component a small amount.

NATIONAL WEATHER SATELLITE PROGRAM

Senator LOTT. General Dickman, the Department of Defense, the Department of Commerce, and NASA have now set up a converged national weather satellite program, which will be jointly funded and managed. The Department of Defense and the Intelligence Community have resisted such convergence in the past due to their specialized need. Have these concerns all been accommodated or is the Department of Defense living with a less than satisfactory outcome?

General DICKMAN. From the Air Force perspective, the Department of Defense and Intelligence Community's concerns have been fully resolved. The key tenets for convergence were reiterated in the Presidential Decision Directive/NSTC–2, May 5, 1994 and the Convergence Implementation Plan, May 2, 1994 submitted to Congress. The Department of Defense and the Department of Commerce have developed a rigorous process for validating and documenting agency operational requirements based upon Department of Defense's requirements procedures. The prime Department of Defense requirements will be incorporated in the National Polar-orbiting Operational Environmental Satellite System (NPOESS).

GLOBAL POSITIONING SYSTEM

Senator LOTT. General Dickman, as the world becomes increasingly dependent upon the Global Positioning System for a wide range of civilian applications as others make use of GPS for military purposes, the Department of Defense will have some tough issues to deal with. How can we deny GPS to military foes or terrorists without denying civilian users? How can we guarantee that the U.S. military which is daily more dependent on GPS, will have guaranteed access? What is being done in the Department of Defense to answer such questions?

General DICKMAN. The details of our work in this area will have to be addressed in a closed session. At a top level our primary means of denying GPS accuracy to military foes and terrorists lies in our use of a technique known as Selective Availability (SA). SA denies unauthorized users the force multiplier advantage gained from the military level of GPS, while retaining a significant level of accuracy benefit for civilian users. The primary threat that SA is designed to mitigate is the exploitation of GPS through widespread equipage of hostile forces, particularly for delivery of precision weapons. However, given that GPS provides a significant level of military utility even with SA invoked we are approaching this from three directions. First, from a global perspective we will retain the use of SA to preserve for the United States and our allies superior positioning, navigation, and timing capabilities in future conflicts. The very presence and continued activation of SA has proven to be effective as deterrent for unauthorized military use of GPS. Next we are addressing denial of GPS from regional, local and selective perspectives. Finally, in order to maximize our denial options and guarantee U.S. military access the United States needs to preserve the second GPS frequency (known as L2) for military use only, as it is today.

SPACE ACQUISITION MANAGEMENT

Senator LOTT. Admiral Anselmo, do you support centralization of space acquisition management in the Office of the Secretary of Defense? Do you believe that we should have attempted at this time to bring the Department of Defense and the Intelligence Community space acquisition into an integrated management structure?

Admiral ANSELMO. We consider the DUSD(Space) to be a major step in the right direction, providing, as it does, a single point of contact for all space matters within the Department. This office promises to improve coordination between policy, architecture and program elements, providing a more seamless and coherent space management process.

The Navy is fully committed to Dr. Kaminski's goals for integrated military and national security space management, and consolidation under a single national security space architect. This is a substantial undertaking, requiring a merger of two communities whose organization, orientation and outlook have been historically quite different. The sooner the defense and national security communities can get together and start on down this road, the better. We're ready to go now.

SPACE ARCHITECT

Senator LOTT. Admiral Anselmo, is the Navy satisfied that it will be adequately represented in the newly established Space Architect organization? What changes, if any, would you recommend?

Admiral ANSELMO. There are two different space architect organizations at issue; at "Step 1", a Department of Defense Space Architect (defense only) and at "Step 2", a National Security Space Architect (defense and intelligence). We believe a fully integrated "Step 2" National Security Space Architect office, built on the National Reconnaissance Office model, offers the best opportunity for full participation of all services and agencies in an organization that is joint, integrated and streamlined. Properly done, substantial savings can be realized through improved processes and substantially reduced infrastructure.

While neither of these organizations are yet fully defined, it's clear that the key to their effectiveness will be the degree to which the user is represented in the process. In our case, we look for joint warfighting requirements to be translated into architectures with a high degree of fidelity and efficiency. This can only be done if the Space Architect office is truly joint, and it will only be truly joint if all services are fully represented at every level throughout the organization.

COMMERCIAL SATELLITE COMMUNICATIONS

Senator LOTT. Admiral Anselmo, to what extent does the Navy rely on commercial satellite communications? In your view, should the Department of Defense make greater use of commercial systems and practices for space?

Admiral ANSELMO. In accordance with HAC fiscal year 1994 guidance and ASD(C^{3}I) commercial satellite policy, Navy's use of commercial satellite communications to augment existing military satellite systems is already substantial and steadily increasing. Current fielding includes International Maritime Satellite (INMARSAT) terminals on all Navy vessels as well as the demonstration of C/Ku wideband capabilities for larger deck ships. Technologies in Personal Communications Systems (PCS) and extremely high data rate Direct Broadcast Systems (DBS) show promise for integration into Navy's future satellite communications architecture; studies are being conducted to best leverage these types of systems for the future.

Military satellite capacity on orbit today does not meet current warfighting requirements; the use of commercial systems to augment this capacity has proven to be a viable short-term solution. With follow-on military satellite constellations in question, commercial systems could prove to be a viable long-term option, however, aggressive commercial competition for assets and lack of funding for long-term (5–10 year) leases may preclude these systems' long term viability. Current Navy funding supports terminals only, and responsibility for space segment/connectivity leases is yet to be determined. The Department of Defense should make greater use of commercial systems to augment military systems.

NAVY ACQUISITION STRATEGY

Senator LOTT. Admiral Anselmo, in bringing on line its current generation of UHF communications satellites, the Navy used a fairly innovative acquisition strategy that included the use of commercial launch services. Was this a successful model that might be applicable elsewhere in Department of Defense space acquisition?

Admiral ANSELMO. We're very happy with the UHF Follow-On (UFO) acquisition and certainly consider it an excellent model for future Department of Defense acquisition programs. By way of background, in 1988 Navy awarded Hughes Aircraft Company a fixed price contract with performance incentive for one spacecraft, incrementally funded in 1988/89. A multi-year option for spacecraft 2–9 was signed in 1989, modified the next year adding limited EHF capability on satellites 4–9. Hughes competed the launch services and subcontracted them to General Dynamics. As a result, launch liability was significantly reduced to the Government.

The UFO contract includes: spacecraft, launch services, launch integration, storage, and on-orbit checkout. The contractor (Hughes) assumes risk until the satellite is tested on orbit and ready for use by the operational users. Additionally, Navy enjoys a single point of contact for all contract/satellite matters, including launch services and operational testing.

The beauty of this approach proved itself in March of 1993, when an Atlas booster malfunction sent UFO–1 into an unusable orbit. Because we had contracted commercially, the Department of Defense wasn't stuck with the bill. The $204 million we received from Hughes in reimbursement substantially offset the replacement cost ($227 million) of UFO–10. With an increasingly competitive commercial environment and decreasing funds in the defense budget, it makes perfect business sense to place the liability of satellite launch and operational testing on the commercial contractor and not on the Government.

NAVY VIEW OF MILSTAR

Senator LOTT. Admiral Anselmo, could you characterize the Navy's view of the Milstar satellite system? What sort of benefits will Milstar bring to Navy operations? What would be the impact of canceling Milstar 5 and 6 and trying to accelerate an advanced EHF system?

Admiral ANSELMO. The Milstar satellites, EHF packages on UFO and FLTSAT, plus EHF user terminals of the EHF satcom architecture provide uniquely protected and robust satellite communications. These protected and robust features include anti-jam and antiscintillation (mitigation of nuclear effects) connectivity, and low probability of intercept and detection. All Milstar service terminals are designed and proven to be interoperable. These features are required for the Navy to operate in the modern joint warfighting arena. The first medium data rate (MDR) Milstar satellite will be launched in fiscal year 1999 and will provide up to 1.544 mbps of protected connectivity.

Fleet response to Milstar communications has been very positive. The submarine fleet is particularly impressed with the clarity, flexibility and reliability of Milstar 1. Additionally, because of the requirement for Low Probability of Intercept/Low Probability of Detection communications in the northern polar region, the Navy and Air Force are working to field a gapfiller EHF polar satellite communications capability.

Any effort which canceled Milstar satellites 5 and 6 would cause a capability gap. The current Milstar program would provide global medium date rate (MDR) connectivity (Milstar satellites 3–6) by 2002. Based upon the Military Satellite Communications 1993 Bottom-Up Review Technical Support Group's assessment, the development, production and launch of an advanced EHF satellite will require 10 years. As a result, the 1996 advanced EHF satellite program start would result in a probable first launch in 2006, thereby delaying global MDR by at least 4 years. This 4 year gap in global MDR connectivity would be unacceptable to the Navy.

GEOSAT FOLLOW-ON

Senator LOTT. Admiral Anselmo, it is my understanding that the Navy is being forced to join NASA for the GEOSAT follow-on, the altimetry satellite that provides surface topography to tactical users at sea. The NASA program relies upon a French payload, which will not provide the Navy with an encrypted downlink. What are the reasons for this decision? Will this alternative satisfy the Navy's requirements?

Admiral ANSELMO. The Navy was not "forced" to join NASA on the follow-on altimetry mission. Navy and NASA studied the possibility of converging the Navy GFO program and NASA-French TOPEX/Poseidon Follow-On (TPFO) option. The NASA position favored the TPFO option based on the ability to meet their scientific requirements and continuation of their collaboration with the French. The Navy position favored the GFO option based on risk of dependence on a foreign spacecraft to meet Navy operational requirements, requirement for data denial in times of crisis (GFO has an encrypted downlink), requirement for a direct downlink, compatibility with Navy ground equipment, and cost.

After numerous discussions, the NASA position remained unchanged: continue the collaboration with the French Space Agency (CNES) and procure a TPFO. NASA/CNES agreed to allow Navy to put a direct downlink on the TPFO and indicated encryption for data denial should not be a problem. Navy costs are estimated to be about $7 million. NASA indicated that they intended to proceed with TPFO, however if they went with GFO (modified to meet NASA requirements), Navy would be expected to fund 50 percent. This would have exceeded the original costs for a Navy-only GFO–2.

OSD indicated a strong desire to reach a joint position with NASA. Since Navy is not funded for the GFO–2, and the GFO–1 which will be launched next year has an estimated 8 year life expectancy, Navy decided that the TPFO presented an acceptable level of risk and cost. With a direct downlink (compatible with Navy ground terminals), encryption capability, and operation by NOAA/NASA/Navy, it will satisfy Navy operational requirements.

SATELLITE CONTROL NETWORK STUDY

Senator LOTT. Admiral Anselmo, U.S. Space Command has conducted a future satellite control network study and concluded that the Air Force and Navy TT&C systems should be merged. Does the Navy support such a merger? If so, under what conditions?

Admiral ANSELMO. The TT&C system merger recommended in the Future Integrated Tracking, Telemetry, and Commanding Architecture Study (FITAS) affects the remote sites (antenna sites) only. What this allows is merging the Navy and Air Force sites into a Department of Defense network with "plug and use" access by either service. The FITAS also transfers full control of the FLTSAT and UFO spacecraft to the Navy. This approach is supported by the Navy: it builds on the strengths of both services—the robustness of the Air Force remote network, and the cost-effective distributed nature of the Navy control system.

The FITAS also recommends an enduring effort be established under the DUSD Space which will include all the services and NOAA and NASA and will build on the FITAS results to determine a future architecture.

NATIONAL WEATHER SATELLITE PROGRAM

Senator LOTT. Admiral Anselmo, what has been the Navy's role in the creation of a national weather satellite program between Department of Defense, Commerce, and NASA? Have all your requirements been satisfied by this arrangement?

Admiral ANSELMO. The Navy has been an active participant in the creation of a national weather satellite system between Department of Defense, Commerce, and NASA. The converged system, National Polar Orbiting Operational Environmental Satellite System (NPOESS), will be acquired and operated by an Integrated Program Office (IPO), in National Oceanographic and Atmospheric Agency facilities in Silver Spring, MD. The Navy is supplying some of the key personnel for this program office including the System Engineer and the Deputy Associate Director for Technology Transition, and a User Liaison.

The Draft Integrated Operational Requirements Document (IORD) reflects Navy requirements, and Navy is a member of the Joint Agency Requirements Group. Navy continues to fund R&D efforts leading to procurement or modification of sensors to meet Navy requirements on the NPOESS.

QUESTIONS SUBMITTED BY SENATOR J. JAMES EXON

STATE OF CURRENT ASSETS

Senator EXON. Dr. Pace, the publication Space News this week contains an article reporting that General Shalikashvili, the Chairman of the Joint Chiefs of Staff, has written to Secretary Perry, expressing alarm at the continuing deterioration of current space constellations. Do you agree that this is a growing problem, and, if so, how would you propose that the committee address this problem?

Dr. PACE. I can't address these claims directly as I don't have any knowledge of the classified planning memo mentioned in the news report. I can say that many, if not all, military space programs are facing major acquisition decisions now and in the immediate future. As current constellations age, the questions of whether, how, and when to replace them naturally arise. The first questions the committee might address are how the functions performed by current and planned military space systems serve the needs of the CINCs, what alternatives exist to meeting those needs, and how to provide stable funding and adequate oversight to ensure that no dangerous gaps develop in U.S. military space capabilities.

COMMERCIAL VERSUS MILITARY

Senator EXON. Dr. Pace, as I look at your forecast for the volume of space activity, it appears that within 5 years the commercial activities will have outstripped military space activities by a wide margin. One of the major differences between military and commercial systems is that we must understand and defend against enemy threats to our military space assets. The commercial world pays far less attention to these threats. Does your forecast suggest that military space customers may face many of the same problems as military computer chip makers now face—that custom, hardened computer chips have no civilian market, so that the cost of military computing hardware has not declined nearly as precipitously as costs for commercial computers? Will the military have to support "specialty houses" to make piece parts for military space systems?

Dr. PACE. To some extent there have always been "specialty houses" to provide unique design, development, test, and manufacturing capabilities for national security space systems. There is little doubt that the resources and pressure for cost reduction and innovation become less as markets shrink in both absolute and relative size. The question today is whether the Department of Defense will incur increasing costs in the future to maintain supplies of unique military parts for space systems. Increasing costs may occur for many reasons, such as fewer suppliers competing to serve a smaller defense market and government unwillingness to allow competition from foreign sources.

Like commercial firms, the Department of Defense faces "make or buy" decisions on parts for its systems, i.e., whether to produce a specific part in a Government facility or Government-owned, contractor-operated facility, or rely on commercial sources. The Department of Defense can lower the potential cost of sustaining unique portions of the defense industrial base by using commercial systems as much as possible, using commercial parts as much as possible, and more closely integrating the civil and military industrial bases. Cost savings by such actions may then allow the Department of Defense to devote resources to unique areas, such as radiation hardened computer chips. Failure to exploit commercial practices and technologies will almost certainly result in higher costs to an increasingly tight defense budget.

Aside from enemy threats, military parts are often required to perform in difficult environments beyond those of commercial markets. Therefore, one of the key risks in relying on commercial parts are the standards to which such parts are held accountable. The Department of Defense should seek to understand where and when the use of military specifications is appropriate in terms of measures such as performance, reliability, and life-cycle costs. Failure to do so could result in complex inventories of military and commercial grade parts that would be more expensive to the Department of Defense than maintaining a single low-rate production factory.

COMBATANT COMMANDERS

Senator EXON. Dr. Pace, during Operation Desert Storm, the theater commander and the subordinate air and ground force commanders all appear to have placed greater reliance on information obtained from theater-based platforms such as AWACS and JSTARS than on comparable information from space systems. To what extent do you believe that this is because the theater-based assets were under the CINC's direct control, while the space-based systems were not?

Dr. PACE. I would have to begin by saying that the information from theater-based systems such as AWACS and JSTARS is complementary to, rather than comparable to space systems. The theater and space-based information systems use different phenomenology and serve different functions in support of the theater CINC. It is his decision as a combatant commander whether or how to use such systems. There are several factors which influence the mix of systems a CINC decides to employ, including the desire to control his assets in-theater and perceptions of the timeliness of response if information is coming from CONUS. In many cases, putting direct control of national space systems (which support multiple users) under a theater commander may be undesirable from the standpoint of degrading other missions and creating additional burdens on deployed staffs to provide the required expertise.

Just as we rely on telephone service and other utilities not under our direct control, so the theater commander may rely on assets not under his direct control. USSPACECOM can and does act as a supporting CINC to the geographic CINCs and Joint Force Commanders, just as CINCTRANS supports those same CINCs and JFCs. The central question does not seem to be one of direct versus indirect control, but the identification of what capabilities the CINC needs to employ and then how should the services organize, train, and equip to provide those capabilities most effectively. The supporting CINCs, space or otherwise, need to continually work at improving their abilities to provide rapid, effective support to other CINCs and should be evaluated on that performance.

[Whereupon, at 11:23 a.m., the subcommittee was adjourned.]

DEPARTMENT OF DEFENSE AUTHORIZATION FOR APPROPRIATIONS FOR FISCAL YEAR 1996 AND THE FUTURE YEARS DEFENSE PROGRAM

TUESDAY, MAY 16, 1995

U.S. SENATE,
SUBCOMMITTEE ON STRATEGIC FORCES,
COMMITTEE ON ARMED SERVICES,
Washington, DC.

DEPARTMENT OF ENERGY WEAPONS ACTIVITIES, NONPROLIFERATION AND NATIONAL SECURITY PROGRAMS

The subcommittee met in open session, pursuant to notice, at 3:56 p.m. in room SR–232A, Senate Russell Office Building, Senator Dirk Kempthorne presiding.

Committee members present: Senators Kempthorne, Thurmond, Warner, Nunn, Exon, Levin, and Bingaman.

Committee staff members present: Richard L. Reynard, staff director and Cindy Pearson, security manager.

Professional staff members present: Lucia M. Chavez, Gregory J. D'Alessio, and Eric H. Thoemmes.

Minority staff members present: William E. Hoehn, Jr., professional staff member.

Staff assistants present: Shelley G. Lauffer and Kathleen M. Paralusz.

Committee members' assistants present: Glen E. Tait, assistant to Senator Kempthorne; Andrew W. Johnson, assistant to Senator Exon; Richard W. Fieldhouse and David A. Lewis, assistants to Senator Levin; Edward McGaffigan, Jr., assistant to Senator Bingaman; Randy J. Rydell, assistant to Senator Glenn; and Randall A. Schieber, assistant to Senator Bryan.

Senator KEMPTHORNE. I have an opening statement, but I am going to hold off on it for a moment.

Senator Nunn, why don't you go ahead.

Senator NUNN. You go ahead, please.

Senator KEMPTHORNE. Mine will take a couple of minutes.

Senator NUNN. I just wanted to ask a question to follow on about the accelerator.

What is the risk of the accelerator, technically? There were a couple of "ifs" that the Secretary mentioned. I'm trying to get clear in my own mind how significant those "ifs" are from a technical risk point of view and an unknown technology point of view.

Dr. HECKER. Senator Nunn, the largest question is one that, compared to today's experience and very highly powered accelerators, we will need to go up by a factor of 100 for the accelerator in order to make the quantities of tritium that we are talking about. This requires a change, essentially, from a pulsed operation of an accelerator to a continuous mode of operation.

We think that we have that risk relatively well in hand. We have talked to the technical communities that have the experience, including, of course, our own people. But what we want to do—and this is built into the time schedule that Mr. Curtis mentioned before—is to go ahead and demonstrate the key aspects of the front end of the accelerator, demonstrate some aspects associated with the target, for the most part to really get industry to the point where it feels comfortable that it can do the right cost estimate in order to produce the tritium.

So these are the things that we now, for the past year, have had extremely strenuously evaluated by the technical community that knows anything about accelerators and that knows something about targets and tritium production.

Dr. SMITH. Senator Nunn, could I respond further?

Senator NUNN. Yes.

Dr. SMITH. As the customer for this product, we did not attempt to have the technical expertise that Dr. Hecker has pointed to. But I did take the trouble to have this reviewed in a number of ways.

One, I brought in my own technical team from the private sector. Two, I assigned the problem to the Joint Advisory Committee—that is chaired by General Larry Welch, a man in whom I have considerable confidence—in order to make sure that practical matters were being considered as well as the technical detail. Three, I have had the Standing Committee of the Nuclear Weapons Council review both the DOE report as well as the report by the Joint Advisory Committee.

In all cases, we have concluded that the technical risk can be reduced to the point where the program should go forward. However, we do, in DOD, insist on a backup. After all, none of us can predict the actual outcome of technological risk. So what Mr. Curtis said earlier about light water targets is extremely important to the Department of Defense.

So to summarize our view on the tritium production, the accelerator produced tritium does have technical risk, but it is acceptable, provided that we have the light water target back up that Mr. Curtis has described.

Senator NUNN. How do the economics play out if you are going to have to have that backup? How much money do you have to spend to hedge against the risk?

Dr. SMITH. Mr. Curtis has responded to that. I think I should ask him to respond again.

Senator NUNN. And then, once you add the hedge as well as the accelerator cost and the time elements involved, and so forth, how does that come out in terms of comparing that to the reactor, in terms of the economics of it?

Mr. CURTIS. Senator, the cost of the contingency option, which is light water reactor targets, is an estimated $100 million over the next 4 to 5 years. That's a total cost. We actually believe that we can get that cost down. The important point is that you want that contingency no matter what your technology choice is for a new tritium production source. Because if you were to choose a reactor, you could lose the reactor. You would need that backup.

Senator NUNN. So that is not extra cost relating to the accelerator?

Mr. CURTIS. No, sir. That is cost that we would prudently incur to give life to the hedging structure in the Nuclear Posture Review and to have a backup, no matter what our technology choice is for a new production source.

Senator NUNN. Thank you, Mr. Chairman.

Senator KEMPTHORNE. Senator Nunn, thank you.

Senator Bingaman, do you have some questions you would like to ask?

Senator BINGAMAN. Thank you, but I would be happy to wait.

Senator KEMPTHORNE. We are going to open the doors, literally, so that folks who have been waiting outside can come in. Let's just take a 2 minute break because it will create a little bit of disruption. [Pause]

OPENING STATEMENT OF SENATOR DIRK KEMPTHORNE, PRESIDING

Senator KEMPTHORNE. Ladies and gentlemen, I will reconvene this hearing. We are now in open session. For those of you who were waiting outside, we appreciate your patience while we had to deal with some topics that really needed to be in a closed hearing.

I would like to thank our distinguished panel that is before us today and we look forward to the opening comments that you will be providing to us. All of you have provided written opening comments, which will be made a part of the record. It is my understanding that Senator Exon is currently at the White House. We have an opening statement from him which, if he is unable to return in time, we will make part of the record as well.

I would like to make some comments about the purpose of this hearing which perhaps gives us an overview of at least where some members of this committee are viewing this whole topic.

The purpose of this hearing is to discuss the concern of many members of the committee that the United States is on a path to a deteriorating nuclear stockpile by virtue of its unwillingness to invest appropriately in the weapon engineering and manufacturing capabilities necessary to ensure that the enduring stockpile can be sustained indefinitely into the future.

This approach is not compatible with the U.S. nuclear deterrent strategy which calls for a hedge against the possibility that the post-Cold War environment may, in fact, deteriorate.

The problem before the committee is three-fold. First, the administration and the previous Congress have endorsed a moratorium on underground nuclear testing. The Department of Energy says that it will take about a decade to put together the technology that may substitute for the confidence provided by underground tests. In testimony before a House committee, Dr. Reis noted that there is no guarantee that this new technology will, in fact, work. In the meantime, we are left without adequate tools to ensure the safety and the reliability of our nuclear deterrent forces.

Second, DOE acknowledges that our current nuclear weapons possess a design life of 20 to 25 years. DOE is now trying to assert that the useful life of these weapons can be extended to perhaps 30 years or, in fact, longer. But there is no hard data or analysis to substantiate this assertion.

Moreover, the DOE does not have the remanufacture and certification capability to replace our aging weapons as they reach the end of their design life.

When I have asked how DOE proposes to address this problem, I have been told that there is no plan. Indeed, Admiral Chiles testified before this committee to this fact. Finally, while a possible and only partial substitute for underground tests is a decade away and remanufacturing and certification requirements are unmet, the committee sees that, beginning in fiscal year 1997, the DOE 5 year national security budget plan proposes an annual funding cut of between $1.2 billion to $1.4 billion from the current $4 billion budget for atomic energy defense activities.

As I see it, based upon DOE's plans, we can't get there from here.

The Department of Energy is making inadequate investments in the weapons that serve as the ultimate foundation of U.S. national security policy. This committee will make the tough choices to ensure a safe and reliable, enduring nuclear stockpile, and I must say, at least from my perspective, that the DOE's plan currently is inadequate.

A partial analysis indicates that the DOE strategy does not appear to be compatible with several of the requirements of the Nuclear Posture Review. For example, the Nuclear Posture Review's requirements include the ability (a) to maintain nuclear weapon capability, (b) to demonstrate the capability to refabricate and certify weapons in the enduring stockpile, (c) to maintain the capability to design, fabricate, and certify new warheads, and (d) to avoid an upload hedge for tritium production.

The principal of reconstituting our nuclear forces is an underlying principle of the nuclear posture review. But when I ask how DOE will meet these requirements, I am told there is no plan.

We want to hear DOE's candid views on all of these matters, especially in view of the classified chart which we have seen earlier today.

Many members of this committee I believe have severe doubts about DOE's strategy, DOE's commitment, and DOE's management ability to meet its responsibilities to the Department of Defense. Atomic energy defense resources are spent on all manner of things inside and outside of the weapons activities budget line. But DOE does not think it needs to rebuild the enduring stockpile.

I believe that this course must change, and I will urge the committee to enforce this change.

Those are my remarks as we set the tone for this hearing.

With that, let me turn to Senator Levin.

Senator LEVIN. Thank you, Mr. Chairman. I do not have an opening statement. I have many questions which come at this from a different direction, a different concern than the ones you have outlined. But I am afraid I will have to ask those for the record. I am not going to be able to stay for more than about 10 minutes.

But I look forward to the testimony from our agencies and would ask the record be kept open for a series of questions that I will have.

Senator KEMPTHORNE. Senator Levin, in light of how we have had to proceed with the closed session first, if you would like to proceed with some questions at this point, I would just ask the panel if you would be understanding as, following Senator Levin's questions, I will then allow each of you the opportunity to make any comments you would like.

With that, Senator Levin, I appreciate your patience.

Senator LEVIN. I very much appreciate yours. I do not want to confuse the order, the usual order of things here. But if it would be all right, I just have some questions for Secretary Curtis.

Senator KEMPTHORNE. Certainly. If you would, proceed.

Senator LEVIN. Mr. Curtis, I asked Secretary O'Leary in early April whether it was true that some of our nuclear warheads can operate effectively, although at a lower yield, with less than their full capacity of tritium. I asked her whether the Department had studied how available tritium could be reconfigured among our warheads if no new tritium is produced in the next several decades and what would be the effect on the yield of those weapons.

That was an April 4 hearing and we have still not received an answer to that question. Can you answer that?

Mr. CURTIS. Well, I can attempt an answer at it, Senator. But you also have in the panel before you today experts who can give you a definitive answer. Let me speak generally to the issue.

As I understand it, it is theoretically possible that weapons can still perform with lesser volumes of tritium than their design requirements. However, all weapons require a minimum amount of tritium to properly perform, and at some point in time, the tritium in each weapon will decay below the minimum levels, thus preventing the weapons from functioning as designed. We do not have data that would suggest the relative degradation of performance related to a less than design requirement of tritium.

So the answer, I think, from the Secretary is theoretically that is so. We have not studied the ability to, in essence, stretch out the tritium supply below design requirements for these weapons because we do not have a database that would suggest how much performance would be degraded. We do believe—as a matter of departmental responsibility, that we must not fail in our mission to support the stockpile, both in terms of its safety and its reliability.

Senator LEVIN. Does that affect more than the yield? Would a reduction in the quantity of tritium in a weapon affect more than the yield of that weapon?

Mr. CURTIS. Well, it will theoretically degrade performance, meaning yield from the weapon.

But you have experts here who can address it more definitively.

Senator LEVIN. Dr. Hecker.

Dr. HECKER. We are talking about the yield?

Senator LEVIN. Okay, we are talking yield.

My next question is this. How much is the DOE paying every year to keep the K-Reactor in cold standby for emergency tritium production?

Mr. CURTIS. About $65 million a year.

Senator LEVIN. And what would be the total cost of actually restarting the K-Reactor to produce tritium, and how long would that take?

Mr. CURTIS. It would take between 4.5 to 5 years, and I believe it's $1.4 billion, $1.4 billion to restart the K-Reactor.

Senator LEVIN. Total?

Mr. CURTIS. Yes, sir.

Senator LEVIN. Over that 4 to 5 year period?

Mr. CURTIS. Yes, sir.

Senator LEVIN. What additional steps would be required in order to have the K-Reactor be in compliance with all applicable environmental laws and regulations?

Mr. CURTIS. The K-Reactor as you know, is a heavy water reactor without a containment structure, and it is not regulated as a commercial reactor. So our estimate is that the $1.4 billion would be required to restart that reactor within the design safety and environmental envelope. Let me hasten to add that the Department of Energy does not believe that that is an appropriate contingency in meeting our tritium requirements because there are significant safety implications with restarting the K-Reactor.

First of all, it is a 41 year old reactor, to this date, even though it had been upgraded through an effort made in the early 1990s. The absence of a containment structure is a concern. But perhaps most significantly it requires a core level of expertise to ensure that the reactor can be operated safely. That core level of expertise is no longer available as the workforce ages and retires.

Senator LEVIN. Going back to the tritium issue, in terms of the reduction of yield, what I will do is just ask the question for the record and then whoever wants to answer it can. What reduction in yield would result from various reductions in tritium availability?

If that is classified, then it can just go in the other record and if it is not classified, it can go in this record. But I will ask that for the record because that is a fairly technical question.

Dr. HECKER. I would just like to come back to this. Obviously, I won't say anything classified, but when you asked your question, whether tritium was a matter of yield, I gave you the answer of yes. But it is not a matter of just the continuously variable yield, that is, that you can, indeed, drop off cliffs. And so, to answer your initial question, you have a whole spectrum of possible effects in terms of where you want to take the tritium away, from which weapons, and at what time. And so, you just have to remember that there are cliffs that you can drop off where you, essentially, would not have a weapon of any kind available.

Senator LEVIN. That is the information which we would appreciate for the record.

Dr. HECKER. We can certainly provide that for the record.

[The information follows:]

[Deleted.]

Senator LEVIN. There are some other questions that I have which I will submit for the record. My time is up.

I want, again, to thank you, Mr. Chairman, for your usual courtesy. Thank you.

Senator KEMPTHORNE. Senator Levin, thank you very much.

With that, let me just allow the gentlemen before us any opening comments that you would like to make. Then I have some questions that I would like to follow up with.

So, Mr. Curtis, if we could, let's start with you.

STATEMENT OF HON. CHARLES B. CURTIS, UNDER SECRETARY OF ENERGY

Mr. CURTIS. Thank you, Mr. Chairman. As you know, I have a prepared statement and, with the permission of the committee, I would like it entered in the record as presented.

Senator KEMPTHORNE. Without objection. And, in fact, all prepared statements will be made a part of the record.

Mr. CURTIS. Mr. Chairman, I would like to make a few brief comments.

First of all, as this committee well knows, the Department of Energy weapons complex is undergoing very significant change, and it has been for a period of years. We also face a formidable challenge, and that is to provide for the safety and reliability of the stockpile in the absence of testing and in the absence of a current production of weapons and, as well, a restriction on the design of new weapons.

This is a considerable challenge that the Department has, in my estimation, very responsibly responded to. We are submitting to the Congress this week a Stockpile Stewardship and Management Program which lays out our approach to meeting this responsibility.

We are submitting a budget of $3.5 billion in fiscal year 1996 to carry out our stockpile stewardship and management responsibilities. That represents an increase of some $300 million, or a 9 percent increase over the amounts appropriated or fiscal year 1995.

We know full well of the out-year challenges that we have in order to carry out this responsibility, and we appreciate the opportunity both to demonstrate to you and the other members of the committee that we are responsibly carrying out our stewardship responsibilities and that we will meet our funding requirements to discharge those responsibilities in future years.

I wish to call the committee's attention in particular to one aspect of our activities, and that involves the initiatives to support our nonproliferation goals through efforts to improve the protection, control, and accountability of nuclear materials in the Russian Federation.

This is an extraordinarily important effort, one that has been developed in large measure through the professionals at the Department of Energy and its laboratories, and one that I believe deserves this committee's strong funding support and, frankly, your applause.

This is an example of public service gone right. It is a way that we can act together to reduce the nuclear danger associated with these materials. And, again, I ask your strong support for it.

I will be happy to answer your questions and I will be happy to engage in the process by which we can improve this committee's confidence that the Department is adequately and responsibly discharging its stewardship responsibility.

[The prepared statement of Mr. Curtis follows:]

Prepared Statement by Charles Curtis, Under Secretary of Energy, Department of Energy

INTRODUCTION

Good afternoon Mr. Chairman and Members of the committee, thank you for inviting me to appear before the committee to discuss the important national security activities carried out by the Department of Energy. These activities continue to experience profound change, change that no one could have predicted only a few years ago. The United States is no longer conducting underground nuclear tests: producing new special nuclear materials, or manufacturing new nuclear weapons. The collapse of the Soviet Union presents a unique opportunity for arms control while raising concerns about the proliferation of weapons-usable materials.

DEFENSE PROGRAMS

Nuclear deterrence remains the cornerstone of the Nation's defense strategy. President Clinton has stated "we will retain strategic nuclear forces sufficient to deter any future hostile foreign leadership with access to strategic nuclear forces from acting against our vital interests and to convince it that seeking a nuclear advantage would be futile. Therefore, we will continue to maintain nuclear forces of sufficient size and capability to hold at risk a broad range of assets valued by such political and military leaders."

The Department now has the challenging responsibility of ensuring the safety, security and reliability of the enduring nuclear weapons stockpile in the absence of testing and in the absence of an active production program. The Department has developed the Stockpile Stewardship and Management Program to meet the challenges involved in ensuring the safety, reliability and performance of the stockpile. The Department's program is designed to:

- Fully support at all times, the U.S. nuclear deterrent with safe, secure, reliable nuclear weapons while transforming the nuclear weapon complex (laboratories and production facilities) to one that is more appropriate for the smaller enduring stockpile.
- Preserve the core intellectual and technical competencies of the weapons laboratories. Without nuclear testing, confidence in the U.S. nuclear deterrent will rest with confidence in the competency of the people who must make the scientific and technical judgments related to the safety and reliability of U.S. nuclear weapons. A "science-based" stockpile stewardship and management program will enable those people responsible for maintaining the U.S. nuclear stockpile to increase their fundamental understanding of the basic scientific phenomena associated with nuclear weapons.
- Ensure that the activities needed to maintain the Nation's nuclear deterrent are coordinated and compatible with the Nation's arms-control nonproliferation objectives.

OFFICE OF NONPROLIFERATION AND NATIONAL SECURITY

President Clinton has made the nonproliferation of nuclear weapons one of the Nation's highest priorities. As the preeminent agency for providing technological and analytical support to guard against the spread of nuclear weapons and weapons-usable materials, the Department of Energy is a major participant in our Federal and international nonproliferation efforts.

The challenges are clear: the collapse of the Soviet Union has offered new potential for nuclear transparency and verified reductions, while raising real concerns about where their former weapons scientists will be employed and over the adequacy of security of their nuclear materials; managing the nuclear heritages of others of the Newly Independent States, such as Kazakhstan and Ukraine; Iraq and North Korea; and concerns over terrorism, perhaps involving stolen fissile materials.

Our nonproliferation focus is five-fold: (1) secure nuclear materials in the former Soviet Union; (2) assure safe, secure long-term storage and disposition of surplus fissile materials; (3) establish transparent and irreversible nuclear reductions; (4) strengthen the nuclear nonproliferation regime, (5) control exports of nuclear technology and materials. The Department's active nuclear nonproliferation program is augmented by aggressive research and development activities, technical and analytical support to treaty development and implementation, and providing timely and customized intelligence to support these efforts.

These vital activities help explain why our Arms Control and Nonproliferation budget request is increasing. The bulk of this increase, for example, approximately $80 million is for programs that deal in concrete terms with materials control and accountability and limiting the spread of Russian weapons expertise through our lab-to-lab efforts with the former Soviet Union.

NUCLEAR NONPROLIFERATION TREATY

On April 17, 1995, delegates from 175 countries gathered in New York to begin deliberations on permanently extending the 25 year old Nuclear Nonproliferation Treaty. On May 11, after a month of hard work by the administration, the delegates agreed by consensus on the permanent extension of the treaty. President Clinton declared that, "this action will build a better future for our children and for future generations." The conferees also agreed on the following set of principles and objectives for nuclear non-proliferation and disarmament:

- *Universality:* Encourages universal adherence to the treaty, by all states not yet party to the treaty, particularly those that operate unsafeguarded nuclear facilities;
- *Non-Proliferation:* Encourages that every effort be made to implement the treaty without hampering the peaceful uses of nuclear energy;
- *Nuclear Disarmament:* Reaffirms the commitment by nuclear weapons states to pursue, in good faith, negotiations on effective measures relating to disarmament, including a Comprehensive Test Ban Treaty no later than 1996, a ban on the production of fissile material, and a systematic effort to reduce nuclear weapons globally;
- *Security Assurances:* Encourages further steps, possibly through an internationally legally binding instrument, to assure non-nuclear weapons states party to the treaty, against the use or threat of use of nuclear weapons;
- *Safeguards:* Reaffirms the International Atomic Energy Agency's authority and encourages nuclear weapons states to place fissile material transferred from military to peaceful nuclear activities under its safeguards; and
- *Peaceful Uses of Nuclear Energy:* Reaffirms the right of all parties to the treaty to develop nuclear energy for peaceful purposes.

MATERIALS DISPOSITION

The end of the Cold War has brought the arms and nuclear materials production race to a close and, as a result, significant quantities of plutonium and highly enriched uranium have become surplus to defense needs in both the United States and Russia. Within DOE, the Fissile Materials Disposition Program directs the development and implementation of decisions on the long-term storage and disposition of surplus weapons-usable fissile materials by building the required technical base together with the necessary sustainable public and political consensus. Fundamental to these efforts is establishing long-term storage and disposition paths which enhance cooperation and reciprocity with Russia.

In June of last year, the Department initiated a Programmatic Environmental Impact Statement (PEIS) on the long-term storage and disposition of weapons usable fissile materials. Much progress has been made. From 37 disposition options initially identified, 11 have been selected for further evaluation in the PEIS. Five involve reactor options; four involve immobilization; and two involve direct geologic disposal. The reduction in the number of options being considered will result in significant savings of cost and time as we move forward. The draft PEIS will be published by the end of this year with a final PEIS and subsequent Record of Decision following near the end of fiscal year 1996.

In addition to the PEIS, the Department recently published in the Federal Register a Notice of Intent to prepare a separate Environmental Impact Statement addressing the disposition of surplus highly enriched uranium. Unlike plutonium, some of the surplus highly enriched uranium can be promptly rendered non-weapons-usable by blending it down with other uranium materials for use in commercial reactor fuel. This is the course of action initiated by the United states and now underway in Russia to eliminate some 500 metric tons of highly enriched uranium from their military stockpiles. Based on an analysis of responses received during the public comment period, the address the proposed transfer to the U.S. Enrichment Corporation of approximately 50 metric tons of surplus highly enriched uranium from the U.S. stockpile for blending and subsequent use as low enriched uranium in commercial power plants. When the U.S. Enrichment Corporation is privatized, receipts from the sale will transferred surplus uranium materials. The draft EIS will be published this summer with a final EIS and subsequent Record of Decision following by early 1996.

Last November, then-secret Project Sapphire concluded with the arrival of approximately 600 kilograms of highly enriched uranium from the Ulba Metallurgical Plant in Kazakhstan for safe interim storage at the Oak Ridge facility in Tennessee. The Office of Fissile Materials Disposition completing the necessary environmental analysis and coordinating efforts with the U.S. Enrichment Corporation to obtain commercial services to blend this material down to low enriched uranium for use in nuclear power plant fuel. The blending of this material could begin this summer and is in keeping with the President's nonproliferation policy whereby the United States will pursue the purchase of highly-enriched uranium from the former Soviet Union and other countries for conversion to peaceful use as reactor fuel.

I would now like to review the findings of the Department's recently completed strategic alignment initiative and the Galvin Task Force. These two initiatives along with other management initiatives undertaken by the Department will help to dramatically restructure and reorient the Department.

STRATEGIC ALIGNMENT

On May 3, the Secretary announced the results of the strategic alignment initiative. The strategic alignment initiative will provide $1.7 billion toward deficit reduction, part of the Department's commitment to reduce our budget by $14.1 billion over the next 5 years. The package calls for closing 24 offices, reducing federal employment by 3,788 and reducing expenditures in areas such as travel, office space, and information management technologies. The Department has submitted legislation to: privatize the three Power Marketing Administrations, the Navel Petroleum and Oil Shale Reserves; and will be submitting legislation to transform the Bonneville Power Marketing Administration into a Government-owned corporation and remove the Federal Energy Regulatory Commission from the Department.

To ensure that the alignment and downsizing actions outlined in this report are completed in a group will be responsible for:

- Reviewing, coordination, and monitoring detailed implementation plans which will be developed by affected organizations within the Department.
- Developing an implementation plan for the FTE allocations for each Department office that will be required to meet our downsizing targets.
- Identifying major departmental policy and administrative processes which should be reengineered for the purpose of enhancing performance, cutting costs, and achieving the FTE reduction commitments contained in this report.
- Providing further analysis for alignment and downsizing of the Department, including additional examination of issues identified by the Strategic Alignment team.
- Providing regular reports to the Secretary on progress on all alignment and downsizing commitments.

The Department's missions in national security, energy, weapons site cleanup, and science and technology are extremely demanding and of great importance to the future of the Nation. Our challenge is to perform these responsibilities within a shrinking budgetary environment. This requires that we do things differently in the future than we have in the past. We must simplify and make sense out of internal processes that currently are burdensome and redundant, and we must save dollars across-the-board. The path we have charted, through the strategic alignment and other initiatives, is both exciting and daunting. Downsizing within the Department will be difficult and restructuring our activities will bring new anxieties to the workforce. However, this is the better way than sacrificing the Department's missions through dismantlement.

DISMANTLEMENT OF THE DEPARTMENT OF ENERGY

In recent months there have been a number of calls to eliminate the DOE and transfer its national responsibilities to the Department of Defense (DOD), all in the name of saving money. A similar proposal was offered by the Reagan administration in 1982. Analysis by the Congressional Budget Office and the General Accounting Office found that no significant savings would be realized if DOE was dismantled. We believe that there is a more important consideration. What is in the best interest of the Nation's defense requirements?

The DOE, its laboratories, and contractors are the preeminent authorities in this country regarding the production of nuclear weapons and the associated materials. The horizontal integration of the nuclear weapon activities within DOE and its "cradle-to-grave" responsibilities for nuclear weapons results in a commitment, continuity, and management flexibility important to program success.

There are clear distinctions between the nuclear weapons activities of DOE and the DOD, distinctions which go back to the end of the World War II and the McMahon Act. These distinctions include not only the differences in size, but also in organization, management approach, and unity of mission. Presidential decision-making concerning weapons has profited from the Department of Energy's and the laboratories technical independence from the military.

The current separation of roles and responsibilities ensures that safety issues are not subordinated to weapons performance considerations. The Galvin Task Force reinforces this perspective by concluding that "there is much value at this time in maintaining an independent and technically expert organization to focus on nuclear stockpile issues and continue to ensure that decisions regarding the safety, control, and stewardship of nuclear weapons are raised to the high policy level that they deserve."

Finally, the success of Stockpile Stewardship and Management program will largely be dependent upon the continued vitality and expertise of the nuclear weapons laboratories. Shifting these laboratories to the Department of Defense would risk the laboratories being sub-optimized to meet a narrower defense-only mission, thus eroding the vitality of the laboratories at an important and historic juncture in the weapons program. Secretary Perry has said that "with the new technical challenges of providing stewardship of the stockpile in the absence of underground testing, this is not the time to be fundamentally restructuring the management of these activities." The Galvin Report concludes "there is no compelling reason for DOD to manage the national security functions" at the weapons laboratories. Experts, including the Chairman of the Defense Nuclear Facilities Safety Board, John Conway, and Dr. Edward Teller of Lawrence Livermore National Laboratory, have recently testified before the Congress against transferring these functions to DOD.

GALVLN TASK FORCE

Last year the Secretary chartered the Task Force on Alternative Futures for the Department of Energy National Laboratories and tasked it with the job of conducting the first post-Cold War assessment of the National Laboratories. The Task Force reaffirmed the vital role of the laboratories in meeting national needs in the mission areas of energy and national security. The Task Force also reaffirmed the enduring national security mission of the DOE laboratories, and the importance of maintaining continued scientific, engineering, and managerial excellence at the laboratories to meet the complex and demanding role of science-based stockpile stewardship.

The Task Force has developed a series of recommendations that challenge the Department and the laboratories to reach new levels of performance in meeting the needs of the Nation. The Department is in general agreement with these findings, and has made a commitment to vigorously implement the majority of the Task Force's recommendations. On April 11, 1995, the Secretary approved the charter for the Laboratory Operations Board. A priority of the Board will be to review and provide advice on how to reduce the direct and indirect costs associated with the management and supervision of the laboratory system. The Secretary also approved criteria that will be used in the selection and management of technology partnerships. It is our expectation that these actions and others, once implemented, will result in a laboratory system that is more efficient, cost effective, and mission focused. We anticipate that the Department's management burden will be reduced and the performance of the laboratories will improve. Success will be measured in terms of lower overhead costs, streamlined oversight systems, reductions in the number and burden of audits and appraisals, and increased productivity.

In the area of national security we are pleased by the Task Force's support for the Department's science-based stockpile stewardship program, including support for the National Ignition Facility. The Task Force correctly observes that the focus of our national security programs has changed dramatically as a result of the end of the Cold War, cessation of nuclear testing, consolidation of most of our nuclear weapons production complex, and new threats posed by the proliferation of weapons of mass destruction.

We agree with the Task Force that one of the most important priorities for our stockpile stewardship mission is to attract and retain skilled scientists, engineers, and managers over the years ahead with the expertise required for the complex and demanding stewardship role. We also agree that the starting point for assessing the future size, budget levels, mission focus, and configuration of the Department's three weapons laboratories must be the national security requirements established by the President. The Department will closely evaluate the Task Force's recommendation regarding a reduction of some of the nuclear weapons functions at Lawrence Livermore and their transfer to Los Alamos. The DOE is developing detailed options for possible changes to the nuclear weapons related activities at Lawrence Livermore for consideration by an interagency working group. These options are scheduled to be presented to the President for decision later this year.

CONCLUSION

The United States continues to face a broad spectrum of nuclear dangers—theft or accident involving nuclear weapons, direct military attack, proliferation, poorly controlled excess of nuclear materials—in a changing world. The challenge for the Department and its laboratories is to apply, in the most cost-effective manner, its unique capabilities and resources to reduce the nuclear dangers. To this end the Department will continue to work on a number of parallel and complimentary programs. The first program is stockpile stewardship and management. This program is structured to maintain our high level of confidence in the safety, security and reliability of the nuclear deterrent while pursuing the administration's goal of completing work on the Comprehensive Test Ban. Second, we will continue our active nuclear nonproliferation program through aggressive research and development activities at the laboratories, and through our lab-to-lab efforts with the former Soviet Union on materials control and accountability. We will continue to provide the necessary technological and analytic support to guard against the spread of nuclear weapons and weapons-usable materials. Third, we will aggressively pursue the technical and management efforts to provide for the safe, secure, environmentally sound long term storage of all weapons-usable fissile materials and the disposition of those fissile materials declared surplus to our national defense needs. The Department will continue to provide the lead technical support to the President's Interagency Working Group on Plutonium Disposition and is conducting joint technical studies with the Russians on options for plutonium disposition.

Senator KEMPTHORNE. Mr. Curtis, thank you very much. We appreciate your comments. Dr. Reis.

STATEMENT OF DR. VICTOR H. REIS, ASSISTANT SECRETARY OF ENERGY FOR DEFENSE PROGRAMS

Dr. REIS. Mr. Chairman, thank you. The Energy Department's Defense Programs in the President's budget request for fiscal year 1996 is $3.5 billion. This is an increase of 9 percent over the equivalent fiscal year 1995 appropriation. This is a large increase in a tough fiscal climate, and it is the first request for an increase after 4 years of sharp decline. But the significance of this request is not a change in funding but a change in programmatic direction.

In the aftermath of the Cold War, the United States has reduced the number of nuclear weapons by 59 percent, and plans to reduce the number by 79 percent by 2003. We have ceased production of new nuclear weapons.

For Defense Programs, this has meant turning over most of the Department of Energy's production plants—Hanford, Rocky Flats, Idaho, K–25 at Oak Ridge, Mound, Pinellas—to our Environmental Restoration and Waste Management office. This year we continue that process by transferring the Savannah River Site.

Reducing the number of active warheads requires an aggressive dismantlement program, and we would continue dismantlements at the maximum safe rate in fiscal year 1996.

These steps are one phase of the Defense Programs response to the ending of the Cold War. To go further, we must define the future role of nuclear weapons and the character of the nuclear weapons stockpile.

This was done in the Department of Defense Nuclear Posture Review (NPR), approved by President Clinton. It affirms that continued maintenance of a safe and reliable U.S. nuclear deterrent remains the cornerstone of U.S. national security policy.

The President further directed the Department of Energy to initiate a Stockpile Stewardship Program. The objective of stockpile stewardship is to maintain a high level of confidence in the safety, reliability, and performance of the U.S. nuclear weapons stockpile without nuclear testing and new weapon production.

Stockpile stewardship was first codified by the Congress in the National Defense Authorization Act for fiscal year 1994. These directives define the future product of Defense Programs and shape the new post-Cold War program.

Defense Programs is charged to deliver a high confidence, affordable, reliable, safe and secure, enduring stockpile of sufficient size and scope to ensure deterrence while simultaneously supporting U.S. arms control and nonproliferation policy.

Because the stockpile must endure, we require a production complex to replace the stockpile when needed, including limited life components and tritium. And, because the world is uncertain, we need the ability to reconstitute test and production.

By directing that the stockpile remain safe and reliable without testing, President Clinton envisioned a future that includes dramatic advances in nuclear arms control while simultaneously retaining nuclear deterrence. The Nuclear Posture Review calls this "lead plus hedge." This is an extraordinary difficult and demanding task. To ensure weapons confidence, we must replace empiricism with deeper scientific understanding of weapons and weapons business. Because we must plan on weapons lasting well beyond their design life, we must measure and understand weapons' aging processes sufficiently to predict and fix problems before they lower stockpile confidence.

We must develop new production techniques to reduce the cost of maintaining and rebuilding weapons, and we must maintain our ability to do tests in a meaningful way if we are to avoid testing. All this represents a world class scientific challenge.

To meet this challenge, we are requesting the start of a new program, Science-Based Stockpile Stewardship, and would entrust its implementation to the three Defense Programs' national laboratories—Los Alamos, Livermore, and Sandia.

These institutions are among the world's best scientific and engineering laboratories and have responded time and time again to problems of national importance.

The fiscal year 1996 budget request begins this task. Some programs, such as dismantlement and supplying limited life components for the active stockpile, remain relatively unchanged. Other programs, such as our technology transfer program, would be reoriented. Included within the fiscal year 1996 budget request are new programs that specifically respond to the President's challenge.

The first is the National Ignition Facility (NIF). When completed, the National Ignition Facility will be the world's largest laser installation. It would create conditions normally found only inside suns and nuclear explosions.

In fiscal year 1996, we would begin to apply neutron radiography to diagnose weapons materials aging, using the Los Alamos Neutron Scattering Center (LANSCE), one of the world's finest such facilities.

And we would begin to develop new computational capability. We require much greater computational power if we are to have the integrated understanding that has heretofore been only available through underground testing.

The fiscal year 1996 budget includes the request for funds for a new source of tritium. The United States has not produced tritium since 1988, and has relied upon tritium from dismantled weapons to support active weapon stockpile.

The use of this recovered tritium will only last until around 2011. So it is essential that we begin the development of a new tritium source now.

Mr. Chairman, this represents some of the highlights of the fiscal year 1996 Defense Programs budget request. It is a different budget than any of its predecessors, but these are different times. It responds directly to the requirements laid on the Department of Energy by the Nuclear Posture Review, specifically recognizing the underlying need for nuclear strength as essential to reducing the nuclear danger.

I look forward to working with the committee, Mr. Chairman, and am prepared to answer any questions that you might have.

[The prepared statement of Dr. Reis follows:]

PREPARED STATEMENT BY DR. VICTOR REIS, ASSISTANT SECRETARY FOR DEFENSE PROGRAMS, DEPARTMENT OF ENERGY

Defense Programs is requesting $3.5 billion in fiscal year 1996, to carry out our Stockpile Stewardship and Stockpile Management responsibilities. In the past, our confidence in the stockpile was ensured through weapon research and development in the laboratories and underground nuclear testing at the Nevada Test Site. In July 1993, the President announced a continuation of a moratorium on underground nuclear testing that has been extended until September 1996. No U.S. tests have been conducted since October 1992. The President has challenged the Department "to explore other means of maintaining our confidence in the safety, reliability and performance of our own weapons." The President also directed that "the plan include stockpile surveillance; experimental research, development and engineering programs; and the maintenance of a production capability to support these efforts." This challenge was codified when the Congress passed the Fiscal Year 1994 National Defense Authorization Act that directed the Secretary of Energy "to establish a stewardship program to ensure the preservation of the core intellectual and technical competencies of the United States in nuclear weapons." It was also substantiated in the Department of Defense's Nuclear Posture Review, completed in October 1994.

These directives, coupled with extremely tight budgets for the foreseeable future, define the future for Defense Programs and thus shape the new, post Cold War program. Defense Programs is charged to deliver:

- A high confidence, affordable, reliable, safe and secure enduring stockpile of sufficient size and scope to ensure deterrence, while simultaneously supporting U.S. arms control and nonproliferation policy. Because the stockpile must endure, we require
- A smaller, more cost-effective production complex to replace the stockpile when needed, including limited life components and tritium. And because the world is uncertain, we need the
- Ability to reconstitute test and production.

The science and technology base, which is primarily resident in the three weapons laboratories; Lawrence Livermore, Los Alamos, and Sandia National Laboratories, is the key to delivering these products. Because the health of the weapons and the vitality of the weapons laboratories are highly correlated, maintaining laboratory competence in all aspects of nuclear weapons is one of Defense Programs' highest priorities.

The current stockpile is safe, secure, and reliable. However the history of the stockpile has shown that continuous surveillance, repair, and replacement of components and subsystems is commonplace. In fact, the seven weapons that will be in the enduring START II stockpile have already been retrofitted to varying degrees and some have had major components of the nuclear system replaced. We cannot predict with any certainty whether or when such problems will arise in the future, but we must be equipped to respond effectively should they materialize.

One method that the Department will use to ensure the continued safety, security and reliability of the stockpile is dual revalidation. Revalidation is intended to provide a baseline assessment, derived without nuclear testing, of the condition of the stockpile today and a process to identify future problems to which the facilities and skills developed under the Stockpile Stewardship and Management Program can be applied. Dual revalidation has two important elements. First, two teams will perform independent evaluations, the first team drawn from the original design laboratory and the second team from the alternate design laboratory. Second, the Department of Defense (DOD) will be deeply involved in this process since it will be managed by the DOD/DOE Project Officers Group and have DOD observers. In essence, revalidation should provide continued confidence in our understanding of the stockpile lost by suspending the test program, and the Stockpile Stewardship and Management Program will develop and maintain the skills and equipment to make necessary repairs or modifications.

To reach the program envisioned, and be consistent with presidential and congressional direction, the Department has restructured the weapons activities account into two closely related and interdependent programs—Stockpile Stewardship and Stockpile Management. The Department will prepare a Programmatic Environmental Impact Statement (PEIS) on the Stockpile Stewardship and Stockpile Management program. This PEIS will support all of the decisionmaking for stockpile stewardship and management. Public scoping meetings are planned for locations near the potentially affected sites this summer. The Department expects to release a draft PEIS by February 1996 and a final PEIS in August of 1996.

STOCKPILE STEWARDSHIP

Our science-based stockpile stewardship program will provide the capability to respond to any problem concerning the safety or reliability of the stockpile in a timely manner by maintaining the necessary skill and judgment bases. Specifically, the program must: (1) develop the means to ensure confidence in the safety and performance of the stockpile without testing; (2) maintain the safety, security, reliability of the stockpile and ensure the capability to replace weapons and weapons components in a timely and cost-effective manner; (3) maintain the nuclear weapons knowledge and skill bases at the laboratories; (4) provide a sufficient scientific understanding of the principles that underpin the safety and performance of nuclear weapons; (5) fill critical gaps in knowledge about age-related changes that might affect weapons system safety, reliability or performance; and (6) ensure the capability to resume nuclear testing if directed to do so by the President.

Basic to the program is the need for improved scientific understanding of age-related changes that might affect system safety or performance, and the ability to respond to new requirements. Improved understanding of warhead behavior over time will be obtained from computer simulations and analyses benchmarked against past data and new, more comprehensive diagnostic information obtained from appropriate laboratory experiments. An improved scientific understanding of the behavior of nuclear weapons will allow our scientists and engineers to have a better basis for anticipating, identifying and solving new problems or to remedy defects that may occur in the enduring stockpile as it ages. This approach will allow the United States to maintain confidence in the stockpile during a nuclear test ban, in a manner consistent with our nonproliferation objectives and arms control commitments.

Implementing these principles will transform the nuclear weapons complex from capacity-based to capability-based. The new enterprise will rely more on scientific understanding and manufacturing agility than test empiricism and manufacturing capacity. The weapons laboratories may assume more responsibility for production capability in addition to their responsibilities for scientific understanding. Having a capability of creating a larger stockpile in an emergency could permit the United States to further reduce its active stockpile if international conditions so warrant.

To meet the objectives of the Stockpile Stewardship program we have three major new initiatives for fiscal year 1996.

(1) *Advanced hydrodynamic testing capabilities and new experimental facilities.* These new capabilities and facilities would improve our understanding of the underlying physics of nuclear weapons, acquire new data and add it to existing data bases, and test and evaluate computer modeling that will provide the future basis for ensuring safety, reliability, and performance of nuclear components. Advanced Hydrodynamic Testing Capabilities provide the closest non-nuclear simulation of the operation of the primary in a nuclear weapon, one of the most crucial, and complex parts of every nuclear weapon. Its properties are central to safety as well as reliabil-

ity and performance. Advanced hydrodynamic experiments capabilities are crucial to resolve issues associated with weapons safety and aging and can provide benchmarks for computer code calibration. Funding of $16 million is included in the fiscal year 1996 budget for advanced hydrodynamic testing capabilities.

One of the most important new experimental facilities is the National Ignition Facility (NIF). The NIF will simulate, on a very small scale, the extraordinary temperatures and pressures that occur during the detonation of a nuclear weapon. NIF will have 192 laser beams which will compress to pressures greater than 100 billion times earth's atmosphere and heat to temperatures of 100 million degrees a small target filled with isotopes of hydrogen to produce fusion reactions. Understanding and controlling fusion in NIF's laboratory setting will enhance our studies of the physics of nuclear weapons by verifying predictions of extremely complex computer models. NIF will help us maintain and improve our core competencies to evaluate the high temperature phase of weapons performance, make the necessary repairs/modifications and subsequently evaluate and recertify those nuclear components. The challenges and research opportunities will make the NIF a powerful draw for world-class scientists and engineers, thus helping ensure that the Nation's continuing national security challenges will be addressed by experts second to none.

Last year the Secretary approved Key Decision (KD–1) for the NIF project. As a result of that decision, the fiscal year 1996 budget requests a total of $61 million for Title I design activities and related operating expenses. The KD–1 process examined the role of the NIF in stockpile stewardship, nonproliferation, the overall DOE energy strategy, and fundamental science while considering lifecycle costs and environmental aspects. The environmental issues associated with the NIF will be considered as part of the Department's Stockpile Stewardship and Management PEIS. The Secretary also established a new project milestone, KD–1 Prime. The new milestone will focus on the nonproliferation, international cooperation and basic science questions associated with the NIF. The Secretary expects to make a KD–1 Prime decision this summer.

(2) *Revolutionary improvements in computer capabilities.* Thousand fold increases in computer speed and data storage capacity are needed. New computer software for weapons analysis, referred to as weapon codes, must be developed to incorporate 3-dimensional geometries, provide higher spatial resolution in critical areas, and eliminate empirical calibrating factors. Increased capabilities are required so that critical data from previous nuclear tests, design and production activities and skills from retiring scientists and engineers can be archived for future use by weapons experts. This challenge will be met through the Accelerated Strategic Computing Initiative (ASCI). The fiscal year 1996 budget includes $45 million to support this initiative. Without underground testing, numerical simulation and computer modeling will be the principal means of recertifying the safety and performance of nuclear primaries and secondaries, predicting full-system behavior, and validating reliability. This initiative will create the leading-edge computational modeling and simulation capabilities critically needed to promptly shirt from nuclear test-based methods to computational-based methods for assuring the safety, reliability and performance of the stockpile. Computer models of manufacturing processes are also needed to ensure highly reliable component production in small lots and the ability to make replacement components to original specifications for the foreseeable future.

(3) *New stockpile surveillance capabilities.* To certify the stockpile in the future we will have to depend on better surveillance tools, scientific data, and computer modeling. We must measure the degradation of safety and reliability as weapons age beyond their design lifetime and beyond our experience. New nondestructive surveillance techniques must be developed to improve our understanding of weapons aging and remanufacture.

A high priority initiative for stockpile surveillance is advanced noninvasive imaging by using x-rays or neutrons to examine the internal components of nuclear weapons without disassembly, in essence a CAT scan for nuclear weapons. The Los Alamos Neutron Scattering Center (LANSCE) will allow our weapons scientists and engineers to develop an improved scientific understanding of weapons design and weapons materials behavior. These data, coupled with improved computational models form part of the basis for weapons certification without nuclear testing. The fiscal year 1996 budget includes $25 million for conducting these activities at the LANSCE.

Testing

President Clinton has instructed the Department of Energy to maintain, as a contingency, the capability to resume underground testing. Our fiscal year 1996 budget includes $206 million, a decrease of $11 million from fiscal year 1995 (as adjusted), to provide for test readiness. The fiscal year 1996 budget for nuclear testing reflects the shift from a 6-month readiness posture to a 2–3 year readiness posture consistent with presidential direction. Ongoing and planned nonnuclear experiments in support of stockpile stewardship and other programs will provide the necessary technical expertise to resume underground testing if so directed by the President. There are no plans to conduct hydronuclear experiments during fiscal year 1996 unless directed by the President, in which case we will notify Congress before proceeding.

STOCKPILE MANAGEMENT

The most important new activity within the Stockpile Management program is initiation of work on a new tritium production source. An integral part of ensuring confidence in the stockpile is providing an adequate supply of tritium, a radioactive gas used in all U.S. nuclear weapons. Tritium greatly increases the explosive force of the warhead. Tritium however has a radioactive half life of 12 years, and must be replenished periodically in order for the weapons to work as designed. The United States has not produced any tritium since 1988, and currently has no production source for this important material. Based on a stockpile consistent with the START II agreement, the United States will need to have new tritium by about 2011 in order to meet requirements, and maintain a 5-year reserve supply. During the interim the United States will continue to rely on tritium recycling to meet our requirements.

The Department released on March 1, 1995, the draft Tritium Supply and Recycling PEIS consistent with our commitment last year to the Congress. The PEIS analyzes four different technologies: Accelerator Production of Tritium (APT), an Advanced Light Water Reactor (ALWR), a Heavy Water Reactor (HWR), and a Modular High Temperature Gas-Cooled Reactor (MHTGR) for tritium production. All four new tritium supply technologies are currently judged to be capable of meeting the 2011 date for new tritium and all could meet the required quantities. Five candidate sites are under consideration for the new tritium facility include: the Idaho National Engineering Laboratory, the Nevada Test Site, the Oak Ridge Reservation, the Pantex Plant and the Savannah River Site. The draft PEIS has been published for public review and comment. The PEIS includes an analysis of the so-called triple play reactor—a reactor that can produce tritium and generate electricity while "burning" plutonium. The PEIS also discusses the environmental impacts of using an existing commercial reactor to make tritium, whether as a contingency in the event of a national emergency or should the Department choose to purchase such a reactor and convert it to defense purposes. The Department does not have a preferred alternative at this time for tritium supply or recycling sites, or for tritium supply technology; however a preferred alternative may be announced prior to completion of the final PEIS. The analyses of cost and technical information regarding the technology candidates are continuing. To help the Department fully understand the cost issues associated with selecting a new tritium source, we have initiated an independent review of the technology cost estimates. The Department has held public hearings in Washington, DC and at potentially affected sites, and will issue a final PEIS in October 1995 followed by a Record of Decision in November 1995.

Dismantlement is another important activity within the Stockpile Management account. Since the end of World War II, the Department and its predecessors have disassembled some 50,000 nuclear warheads in a safe, secure, and efficient manner. Since the beginning of the current fiscal year dismantled 983 warheads, and expect to complete about 1,500 total for fiscal year 1995. In fiscal year 1996, Defense Programs plans for the safe dismantlement of approximately 2,000 nuclear warheads at the Pantex Plant. Unlike the mission workload at most other weapons complex sites, the Pantex workload is expected to remain stable for the next several years as we reduce the nuclear stockpile.

The Stockpile Management program is also responsible for the hands on, day-to-day functions and operations involved in maintaining the enduring nuclear weapons stockpile. Each year a statistically significant fraction of every weapon type in the active stockpile will be evaluated against design requirements, as well as flight tests of modified warheads (in which fissile materials are replaced with simulant materials), to verify nonnuclear performance in a delivery environment. Currently, more than a hundred weapons are removed annually from the stockpile for laboratory and flight tests. For the aging, less-diverse enduring stockpile, new evaluation techniques must be developed to identify and deal with common-mode failures that could negate a significant fraction of the stockpile.

In the past, safety and reliability concerns could be addressed by replacing older weapon systems with new ones incorporating modern safety, security, and performance features. Since there are no new weapons in development or production, this approach is no longer possible. Instead, we will retrofit, upgrade, or replace stockpile weapons to ensure their continued safety, security, and reliability. Indeed, one of the weapon systems slated for the enduring stockpile is currently being retrofitted at Pantex with safety, security, and reliability upgrades, and several other retrofits are planned for the next 5 years.

The Stockpile Management Program calls for new approaches to ensuring the ability to correct problems that will undoubtedly occur in the aging stockpile. To start with, safety margins will be increased (which may include major modifications to primaries), use-control technology will be enhanced, and components produced with "sunset" technologies (i.e., products and processes that become obsolete because of, for example, increasingly stringent environmental or safety regulations) will be replaced. To accomplish these objectives cost effectively, we will conduct planned product-improvement programs that will significantly advance the safety, security, reliability, and/or maintainability of stockpile weapons. To extend the lifetime of weapon components without jeopardizing safety or reliability, we will use improved predictive capabilities, made possible by a combination of computational modeling and experimentation, to define age related changes in materials properties and will engage in preventive maintenance (before a problem develops) of the stockpile. This approach has already been used successfully for such limited-lifetime components (LLCs) as neutron generators and tritium reservoirs, and it may be possible to extend this approach to entire weapon systems. Not only will these activities ensure and improve the safety and reliability of the enduring stockpile, but they will also exercise and sustain much of the skill base required for nuclear weapon development and production and thus help maintain the Nation's nuclear competency.

Improvements to the stockpile must be made through a strategy that does not call for significant new weapons production or complete rebuilding of the enduring stockpile. It is not cost effective, and perhaps not even feasible, to simply replace individual weapons when they reach the end of their original design lifetime (20 to 25 years depending on weapon type). A new strategy will be developed in conjunction with the Department of Defense. The new approach will rely extensively on preplanned lifetime extension projects and, whenever a major retrofit is not cost effective, on one-for-one complete system replacements. The retrofit/rebuild schedules will be phased to level the production and recertification workload and to ensure sustainable effectiveness of design, engineering, and production capabilities in every critical area.

The Stockpile Management program is also responsible for the transportation and storage of nuclear weapons and nuclear materials and for the dismantlement of retired weapons and safe storage or disposal of the resulting materials. Consistent with our commitment to the Department of Defense to support the enduring stockpile, the fiscal year 1996 budget request will allow us to deliver the following products and services: conducting 100 destructive and nondestructive tests of weapons components; delivering 711 limited life component kits to the Department of Defense, and filling and replacing 1,000 tritium reservoirs; and dismantling nuclear warheads. The program provides support for the military on routine field maintenance operations as well as radiological/nuclear accident response capabilities. These functions must be provided as long as the United States relies on nuclear weapons for deterrence.

FISCAL YEAR 1996 BUDGET SUMMARY

The following table (1) breaks out the fiscal year 1996 budget requirements for Defense Programs in the Weapons Activities appropriations account. The request of $3.6 billion, reflecting our total obligational authority requirements, is allocated among three major program areas: Stockpile Stewardship ($1.6 billion); Stockpile Management ($1.9 billion); and Program Direction ($0.1 billion). When adjustments are made for the use of prior-year unobligated balances ($86 million) and the application of cost savings ($25 million), the total new obligational authority required is reduced to $3.5 billion. This represents a 9 percent increase over our fiscal year 1995 budget.

TABLE 1.—DEFENSE PROGRAMS, FISCAL YEAR 1996 CONGRESSIONAL BUDGET

[Dollars in millions]

	Fiscal year	
	1995	1996
Stockpile Stewardship:		
Core Stockpile Stewardship	$1,045	$1,110

TABLE 1.—DEFENSE PROGRAMS, FISCAL YEAR 1996 CONGRESSIONAL BUDGET—Continued

[Dollars in millions]

	Fiscal year	
	1995	1996
Inertial Confinement Fusion	176	241
Technology Transfer & Education	236	249
Subtotal	$1,457	$1,600
Stockpile Management:		
Core Stockpile Management	$1,433	$1,556
Radiological/Nuclear Accident Response	69	71
Reconfiguration	152	121
Tritium Source	0	50
Materials Surveillance & Tech Support	103	106
Subtotal	$1,757	$1,904
Program Direction	$141	$117
Weapons Activities (Total Obligational Authority)	$3,356	$3,621
Adjustments:		
Use of Prior-Year Balances	(143)	(86)
"Reinventing Government" Savings	0	(25)
Weapons Activities (New Obligational Authority)	$3,213	$3,509

CONCLUSION

We must take positive steps to preserve high confidence in the safety and reliability of the enduring stockpile without nuclear testing. This raises the questions of how one measures confidence and what level of confidence is desired. Confidence is subjective and, as such, rests on the judgment of people. Judgment is based on information, experience, and trust in the sources of the information and experience. This link between confidence, judgment, and people is the reason that the competency and experience of our weapons scientists and engineers are so crucial to the U.S. nuclear weapons program. As a result, maintaining this competency base, which exists primarily at the weapons laboratories, is one of the highest priorities of the Stockpile Stewardship and Management Program. We need to preserve and pass on the competency base developed during the years when nuclear testing was permitted. It is this need that drives our efforts to retain the staffs of test-experienced weapons scientists and engineers and to attract talented new people to the program. In turn, these efforts are behind our push to maintain the weapons laboratories with their reputations for scientific and technical excellence, to engage in research and development programs that are nationally important and technically challenging, and to support state-of-the-art experimental facilities and technical capabilities.

To ensure that Defense Programs has the properly trained technical staff to carry-out and manage the stockpile stewardship and stockpile management program we are currently conducting a needs analysis. The needs analysis will identify the knowledge and skills of the existing workforce and establish training requirements. For those positions that cannot be filled through additional training, Defense Programs will selectively recruit highly qualified staff.

Clearly then, preserving high confidence in the safety and performance of the enduring U.S. stockpile without nuclear testing will require an improved, more complete, more accurate understanding of the underlying physical principles involved in nuclear weapons. In turn, this will require new experimental capabilities and greatly improved computational capabilities. As these new capabilities come "on line" and we gain experience in their use and demonstrate the validity of the information they provide, we believe we will be able to certify the continued safety and performance of the stockpile.

Science-based stewardship and management of the U.S. stockpile has never been done before. Meeting this challenge will be neither inexpensive nor without risk. If the strategies laid out by the Stockpile Stewardship and Management Program are followed, both in the near term and the long term, we are confident that we will successfully meet this new challenge.

Senator KEMPTHORNE. Dr. Reis, thank you very much. Dr. Smith.

STATEMENT OF DR. HAROLD P. SMITH, JR., ASSISTANT TO THE SECRETARY OF DEFENSE FOR ATOMIC ENERGY

Dr. SMITH. Thank you, Mr. Chairman.

Much of my preliminary comments have been covered in the closed session and have been reviewed by Dr. Reis and Mr. Curtis. I would like to emphasize Dr. Reis' point that nuclear deterrence remains the cornerstone of our defense. Therefore, we have a shared responsibility—we, the DOE and the DOD—to have high confidence that our stockpile is safe, secure, and reliable. And not only must we be confident but, most importantly, deterrence works only if our potential adversaries are confident that we have a safe, secure, and reliable stockpile.

It is not an easy task, as Dr. Reis has said. We will soon have the oldest stockpile on record. We are facing enormous budgetary pressures to reduce the infrastructure that supports that aging stockpile. We have agreed to engage in no further testing and yet, at the same time, to maintain the same exacting conditions on the stockpile that pertained throughout the Cold War.

To describe how the partnership works, I have chosen a customer-supplier metaphor, obviously DOD being the customer. We specify the requirements through the NPR and we convey them to the Department of Energy in the Nuclear Weapons Stockpile Memorandum, a document signed jointly by both the Secretary of Defense and the Secretary of Energy.

The results you might say of that order book of the Nuclear Weapons Stockpile Memorandum is overseen by the Nuclear Weapons Council. Mr. Curtis sits on that council. I am the secretary to it. Dr. Kaminski is the chairman, and Admiral Owens, the Vice Chairman of the Joint Chiefs of Staff, participates.

This has been a smoothly functioning council, and we expect that it will continue to operate as the right instrument to ensure the viability of the partnership I have referred to.

We, in DOD, have a responsibility today that we did not have in the past, and that is that we must now be an educated customer.

In the past, a full yield nuclear test was certainly a very convincing piece of evidence that, in fact, the stockpile was reliable, not to mention safe and secure. We can no longer have that tool and, therefore, we have an obligation to educate ourselves on exactly what is the status of the various reports that will come to us from DOE regarding the status of the stockpile.

The NPR has been cited over an over again. I would like to simply specify some specifics in the leading and hedging strategy that Dr. Perry has set forth.

In the sense of leading, that is, leading the world to a way of smaller arsenals, we are already reducing toward START I, we and the Russians. It is interesting to note and heartening to note that START I entered into force in December of last year. It will remain in force for 7 years. And yet, both we and the Russians have already met, have already proceeded 40 percent of the way down our path, so that we are, both countries, way ahead of schedule. I think that is a very encouraging sign.

We, the United States, have no ground combat nuclear weapons. We have no nonstrategic nuclear weapons at sea. We have no strategic bombers on alert.

The number of storage facilities has been reduced by 75 percent. The number of personnel who handled nuclear weapons has been reduced by 70 percent.

We are, indeed, as a nation not hesitating to lead in the dismantling of the greater part of our nuclear weapons stockpile.

On the hedging side, it has become quite clear in this hearing that special nuclear material, tritium, limited life components, must be manufactured or remanufactured in sufficient quantities to allow us to return to START I levels if the President should decide that that is necessary.

We must have improved stockpile surveillance. We must have the ability to refurbish and refabricate and, if necessary, even redesign. And, of course, we must have the science and technological base to underpin all of the above.

That is the hedging side of the Nuclear Posture Review.

It is DOD's judgment today that the stockpile is safe, secure, and reliable. And, while we await the detailed plan that will take us into the brave new world of the future, we judge the DOE defense programs budget for 1996 to be adequate.

We would recommend most strongly that that budget be maintained in the out-years, and possibly increased if remanufacturing is required.

I would like to thank you, Mr. Chairman, for the opportunity to make this statement and I look forward to your questions.

[The prepared statement of Dr. Smith follows:]

PREPARED STATEMENT BY DR. HAROLD P. SMITH, JR., ASSISTANT TO THE SECRETARY OF DEFENSE (ATOMIC ENERGY)

INTRODUCTION

Mr. Chairman and Members of the subcommittee, it is an honor and a privilege to have this opportunity to appear before you. As the Department of Defense official most closely associated with the viability of the Nation's nuclear deterrent, I accord nuclear weapon safety, security, and reliability the highest priority. Because the nuclear weapons of our enduring stockpile will be retained in the inventory well beyond their designed lifetimes, the stewardship responsibility shared by the Departments of Defense and Energy is more challenging today than at any time in the past. I am pleased to report that the two Departments are continuing a history of cooperation in executing our shared responsibility.

THE NUCLEAR POSTURE REVIEW

With the end of the Cold War, the Department of Defense undertook a lengthy, zero-based, major review of the Nation's future nuclear weapons requirements. This review was the first such comprehensive review in 15 years. Completed this past September and approved by the President, the Nuclear Posture Review, or NPR, provides broad policy guidance, force structure requirements, and stewardship obligations for the enduring nuclear weapons stockpile.

In a world of uncertainty and still evolving security needs, the NPR concluded that nuclear weapons, and nuclear deterrence, will remain an essential element of U.S. national security. However, the size, form, and context of that deterrent are significantly different from that which served us so well during the Cold War.

The force structure envisioned in the NPR is significantly reduced from that at the height of the Cold War. This force structure for the year 2003 will be comprised of 14 Trident ballistic missile submarines, 66 B–52 and 20 B–2 bombers, and three wings of Minuteman III ICBMs with each missile downloaded to a single-warhead. The Navy would retain the capability to deploy non-strategic nuclear warheads on Tomahawk land-attack missiles on attack submarines. This equates to a 47 percent reduction in active strategic warheads and a 90 percent reduction in active non-strategic warheads from the 1988 level. Overall, compared to 1988, the total active stockpile has been reduced by 59 percent.

Second, the NPR focused heavily on a number of additional actions that have been or are being taken to improve nuclear safety, security, and use control. For example, no nuclear weapons remain in the custody of U.S. ground combat forces. Non-strategic nuclear weapons are no longer deployed at sea. Strategic bombers remain off day-to-day alert. Furthermore, strategic nuclear weapons storage locations have been reduced by 75 percent and personnel with access to nuclear weapons or their control have been reduced by 70 percent.

The NPR sought to achieve a proper balance between what Secretary Perry has called "leading and hedging." By this, he means the United States should lead in proposing continued reductions in nuclear weapons while retaining the ability to respond to the emergence of a new nuclear threat, including a possible reversal of trends in Russia. While the NPR force structure projections were based on the assumption that the START II Treaty would enter into force by the year 2003, the practical implication of our policy to "lead and hedge" has meant that DOD must plan for a variety of possible nuclear force structures—ranging from faster, deeper cuts in the nuclear weapons stockpile to reconstituting, or maintaining a START I level.

The NPR also contains specific requirements from DOD to DOE to preserve the infrastructure of the nuclear weapons complex. DOE must maintain their nuclear weapons capability without underground nuclear testing, the production of fissile material, or new-design warheads. Specifically, DOE's task is to:

— Develop a stockpile surveillance engineering base;

— Demonstrate the capability to refabricate and certify weapon types in the enduring stockpile;

— Maintain the capability to design, fabricate, and certify new warheads;

— Maintain the science and technology base; and,

— Ensure the availability of tritium.

To meet these challenges, the Department of Defense, in partnership with the Department of Energy, must address three basic issues. First, how does DOD, as the customer, determine the requirements and characteristics for the future stockpile? Second, how are these requirements communicated to the supplier, the Department of Energy? Third, how do the two Departments most efficiently maintain that stockpile?

The NPR broadly defines the outyear force structure requirements and provides the basis to develop and establish necessary refurbishment and replacement materials. A draft NPR Implementation Plan under development by DOD will provide a description of the steps necessary to reach the nuclear force structure of the 21st century. The President and the Secretary of Defense will determine if the nuclear weapon stockpile shall be reduced, maintained, or reconstituted to START I levels. Whatever nuclear stockpile is determined to be appropriate for U.S. requirements, the maintenance of a safe, secure, and reliable nuclear weapon stockpile requires a professional cadre of technical nuclear design personnel. Additionally, to support the materiel requirements of the enduring stockpile, the United States must maintain a Strategic Reserve of highly enriched uranium, weapons grade plutonium, and tritium. The process for ensuring these essential capabilities is conducted through the Joint DOD/DOE Nuclear Weapons Council.

THE NUCLEAR WEAPONS COUNCIL

The Nuclear Weapons Council is an interdepartmental (DOD and DOE) organization which manages, reviews, and arbitrates nuclear weapons issues relative to the maintenance of a reliable, safe, and secure stockpile and supporting infrastructure. Membership of the NWC consists of the Under Secretary of Defense for Acquisition and Technology, Under Secretary of Energy, and the Vice Chairman of the Joint Chiefs. The Council is supported by the NWC Standing and Safety Committee, which I chair.

A central activity of the NWC is the preparation of the annual Nuclear Weapons Stockpile Memorandum (NWSM) which provides the Defense Department's nuclear weapons requirements to the Energy Department. The NWSM reflects the current and projected status of the stockpile. Broadly consistent with both the NPR and the START I Treaty limitations on delivery vehicles, the NWSM establishes the total number of nuclear warheads in the U.S. stockpile. The Council prepares the NWSM, oversees its implementation, and ensures that national policy is being efficiently executed.

In addition to the NWSM, over the past year the Council has directed considerable time and effort to issues related to the safety, security, and reliability of the aging stockpile. As an example of a key decision with long-term implications, the Council recently considered alternative source and production programs to ensure a future supply of tritium. The Council concluded that accelerator-based production of tritium could meet the needs of the enduring stockpile, but the Council encourages the development of a contingency source for tritium.

STOCKPILE STEWARDSHIP AND MANAGEMENT PROGRAMS

An additional requirement directed by the Fiscal Year 1994 National Defense Authorization is: "a stewardship program to ensure the preservation of the core intellectual and technical competencies of the United States in Nuclear Weapons." In response, the Department of Energy, with the support of the Defense Department, is establishing the Science Based Stockpile Stewardship (SBSS) Program. This program is designed to preserve the capability to design and produce replacement weapons while simultaneously dismantling obsolete weapons under the tightest safety and security provisions.

In particular, the Stockpile Stewardship Program will provide improved forensic and diagnostic capabilities. The essence of the SBSS program includes: (1) a surveillance program to predict reliability, identify areas of research, and suggest corrective actions, (2) an analysis program to correlate data from previous underground tests and above ground experiments; and (3) an activity to support the design of new or replacement warheads. The SBSS program complements the Stockpile Management program which is tasked with assuring that the active and inactive stockpiles meet military requirements. The pivotal question facing the two programs is whether warhead defects can be predicted with a sufficiently long lead time to permit repair or complete rebuild without impacting the operational posture of the stockpile. Involuntary or unplanned reductions of the operational posture of the stockpile are unacceptable and must be prevented.

INDEPENDENT ASSESSMENT

As the stockpile decreases with a concomitant increase in demilitarization requirements, a parallel and critical activity is the technical evaluation of the weapons remaining in the stockpile. The basic elements of such an evaluation are in place in the form of the nuclear competencies of the national laboratories and the DOD. The Science Based Stockpile Stewardship Program will build on these centers of nuclear excellence by developing a robust peer review process with both DOE and DOD participation. This peer review process will provide a technically sound structure and methodology to ensure a safe, secure, reliable nuclear weapons stockpile.

CONCLUSION

I can confidently report today that the stockpile is safe, secure, and reliable. It also meets the requirements of Office of the Secretary of Defense and the services. The fiscal year 1996 budget request provides sufficient funding to meet our responsibilities. Funding in the outyears must provide the capability to meet the requirements specified in the Nuclear Posture Review and the Nuclear Weapons Stockpile Memorandum.

For the future, the combination of the Stockpile Stewardship and Stockpile Management Programs, aggressive stockpile surveillance, and a robust program of independent peer review provides the means to partially offset the loss of nuclear testing. However, without testing, there will be potential for erosion in the degree of confidence in the individual and collective characteristics of the stockpile. Maintaining adequate confidence will be challenging in such an environment, but I believe that we are on the right track to address this critical issue.

Since the Manhattan Project, the Nation has invested heavily in the development, production, deployment, and maintenance of the national nuclear deterrent. Proper stewardship is, therefore, an enduring responsibility. It is imperative that the Nation continue to provide the resources to fulfill this responsibility.

Mr. Chairman, this concludes my statement. I would be pleased to answer your questions and those of your colleagues.

Senator KEMPTHORNE. Dr. Smith, thank you. I appreciate your comments. Mr. Baker.

STATEMENT OF KENNETH E. BAKER, ACTING DIRECTOR, OFFICE OF NONPROLIFERATION AND NATIONAL SECURITY, DEPARTMENT OF ENERGY

Mr. BAKER. Good afternoon, Mr. Chairman, Senator Exon. It is a pleasure to address you today as the Acting Director of the Office of Nonproliferation and National Security at the Department of Energy.

Our activities focus on three areas: reducing the global nuclear danger, providing effective cost-effective safeguards and security of the Department, and improving the Department's emergency response capability.

Today I would like to address one area in my testimony and that is nuclear nonproliferation.

Nuclear nonproliferation has become one of the highest national security priorities and the Department of Energy is leading the way in providing technological and analytical support to U.S. and international nonproliferation efforts. We perform aggressive research and development activities in support of national and international nonproliferation concerns—specifically, proliferation detection technology and treaty verification. And, we provide timely and customized intelligence to define this serious national security problem for the United States.

Over the past year, we have made significant accomplishments in reducing the global nuclear danger.

Our program of cooperation, mentioned by Mr. Curtis, between DOE laboratories and nuclear research facilities in Russia to improve protection, control, and accounting of nuclear weapons material is yielding dramatic results.

At the Kurchatov Institute on the outskirts of Moscow, the United States and Russia jointly collaborated to secure weapons grade nuclear materials. The pace of this improvement was extraordinary. Work was completed in 3 months. The cost was modest, just shy of $1 million.

SECURE MATERIALS

Before After

Kurchatov Institute

SECURE MATERIALS

Kurchatov Security Control

Mr. BAKER. On the left, sir, I would like to show you what we have done. When we entered Kurchatov last fall, the before picture showed what looked like woods. We went inside the facility. We found that there was no fence. Inside the facility there were no radiation detection systems. There were no monitors. There were no alarm systems. One guard was guarding the facility.

We walked inside the facility and we found lockers, like you would find in a college locker room, with padlocks on them. We opened up one lock and found a significant quantity of highly enriched uranium.

We did many things to improve the situation. This program, as I said, was $1 million. We put in a new radiation detection system. We put in monitors. We put in alarm systems where they can monitor the alarms. We put in a new fence. We did all of this in a very short time and with less than $1 million.

As I told you in the classified section, there are so many more of these, we would have to do the same thing.

So the program will significantly expand in the coming year with the promise of securing tons of weapons usable material, not just kilogram quantities.

Last November, we successfully transferred approximately 600 kilograms of highly enriched uranium from Kazakhstan to the Department's Oak Ridge facility in Tennessee for safe and secure interim storage. By gaining ownership of this material, the United States has effectively removed it from potential acquisition by those who could develop weapons of mass destruction.

We have developed and deployed space based sensors capable of detecting atmospheric and near-earth explosions. These sensors, on Defense Department satellites, provide a system for the United States to continuously detect nuclear explosions and verify treaty compliance worldwide.

During 1994, we were assigned the responsibility as the U.S. Government's primary agency for research and development of technologies supporting the U.S. requirements to monitor a future Comprehensive Test Ban Treaty. We have also provided technical expertise and policy recommendations in support of diplomatic efforts to achieve an indefinite extension of the Nonproliferation Treaty, a cornerstone of U.S. national security policy.

As you know, the Nonproliferation Treaty has been indefinitely and unconditionally extended.

Our activities will continue to further the goals of the Nonproliferation Treaty in the future. In addition to these accomplishments, there is still much more to do. Our requested increase of $86 million over fiscal year 1995 will allow us to accelerate these essential nonproliferation efforts and reduce the global nuclear danger.

The Department will expand its efforts to end the civilian production and use of weapons usable, fissile materials. We will continue our efforts to monitor U.S. and Russian inventories of plutonium and highly enriched uranium from weapons dismantlement, with a goal of ensuring that dismantlement is irreversible.

We will advance nonproliferation by our efforts in North Korea, which are funded this year by the recently approved reprogramming, by supporting negotiations of a Comprehensive Test Ban Treaty and an International Fissile Material Cut-off Convention, and by facilitating International Atomic Energy Agency activities the world over.

I will be happy to address any questions that you may have.

[The prepared statement of Mr. Baker follows:]

PREPARED STATEMENT BY KENNETH E. BAKER, ACTING DIRECTOR, OFFICE OF NONPROLIFERATION AND NATIONAL SECURITY, DEPARTMENT OF ENERGY

Good morning Mr. Chairman and Members of the subcommittee. It is a pleasure to address you today as the Acting Director of the Office of Nonproliferation and National Security at the Department of Energy (DOE).

The Department has long been actively involved in preventing proliferation of nuclear weapons technology and protecting nuclear material and facilities. Moreover, in the post-Cold War era, the Department and its system of national laboratories have conducted a vigorous program of nonproliferation research and development with direct benefit to countering the threat of proliferation.

This office oversees the unique capabilities that support a core program of nuclear nonproliferation activities even as we make efficient use of our unique technical capability to support and develop advanced technologies aiding in the detection and countering emerging proliferation threats. Consequently, this office provides a wide range of services for a broad range of domestic constituencies and nonproliferation regimes.

The challenges are clear: the collapse of the Soviet Union has offered new potential for nuclear transparency and verified reductions, while at the same time raising real concerns about where their former weapons scientists will be employed and over the adequacy of security of their nuclear materials; managing the nuclear heritages of others of the Newly Independent States, such as Kazakhstan and Ukraine; Iraq and North Korea; and concerns over terrorism, perhaps involving stolen fissile materials.

The programs of the Office of Nonproliferation and National Security address these and other threats. President Clinton has made the nonproliferation of nuclear weapons one of the Nation's highest priorities. The United States is committed to weave this element of our policy more deeply within the fabric of our relationships with the world's nations and institutions. As the preeminent agency for providing technological and analytical support to guard against the spread of nuclear weapons and weapons-usable materials, the Department of Energy is a major participant in our Federal and international nonproliferation efforts.

Today, I would like to focus on three key areas that address aspects of the mission and threats discussed above: reducing the global nuclear danger; providing effective, cost-efficient safeguards and security of the Departmental complex while fostering public trust through openness; and improving the Department's emergency response capability. In addition to meeting national security requirements, the office also is a vital contributor to the Department's science and technology, environmental quality, energy resources, and industrial competitiveness missions of the Department, all of which directly affect the security and quality of life of every American.

The fiscal year 1996 request for nonproliferation and national security activities is $573.7 million, less an offset of $13 million of prior year balances for a net fiscal year 1996 Congressional Budget request of $560.7 million.

Our nonproliferation focus is five-fold: (1) secure nuclear materials in the former Soviet Union; (2) assure safe, secure long-term storage and disposition of surplus fissile materials; (3) establish transparent and irreversible nuclear reductions; (4) strengthen the nuclear nonproliferation regime, and (5) control exports of nuclear technology and materials. The Department's active nuclear nonproliferation program is augmented by aggressive research and development activities, technical and analytical support to treaty development and implementation, and providing timely and customized intelligence to support these efforts.

Over the past year, we have made significant accomplishments in reducing the global nuclear danger:

- We lead a program of cooperation between DOE laboratories and nuclear research facilities in Russia to improve the protection, control, and accounting of nuclear materials which could be used to make nuclear weapons. A demonstration project was successfully undertaken to upgrade and enhance the protection of the Kurchatov Nuclear Research Center in Moscow during 1994 and plans are in place for follow-on demonstrations at several more sites during 1995.
- Project Sapphire, a formerly-secret operation, successfully transferred approximately 600 kilograms of highly enriched uranium from the Ulba Metallurgical Plant in Kazakhstan to the Department's Oak Ridge facility in Tennessee for safe and secure interim storage. By gaining ownership of this material, the United States has effectively removed the material from potential acquisition by those who could develop weapons of mass destruction. The uranium is currently in interim storage at the Y–12 plant in Oak Ridge until it can be moved to a commercial facility where it will be converted to low enriched uranium for use in commercial nuclear power plants in the future.

- We have completed development and deployment of Space-Based sensors capable of detecting atmospheric and near-Earth nuclear explosions. These sensors, on Defense Department satellites, provide a system for the United States to *continuously* detect nuclear explosions and verify treaty compliance *worldwide.*
- During 1994, the responsibility for research and development of technologies to support U.S. requirements to monitor a future Comprehensive Test Ban Treaty (CTBT) was transferred from the Department of Defense to the Department of Energy (specifically to the Office of Nonproliferation and National Security). We have enlisted four of our National Laboratories—Livermore, Los Alamos, Sandia, and Pacific Northwest— to develop technological options for verification of arms control policy.
- We have also been providing, and will continue to provide, technical expertise and policy recommendations in support of diplomatic efforts to achieve an indefinite extension of the Non-Proliferation Treaty, a cornerstone of U.S. national security policy. The treaty was successfully made permanent on May 11, 1995 at the United Nations Review Conference. Our support included development of overall strategy, initiatives for transparency and irreversibility (including placing excess materials under International Atomic Energy Agency safeguards), technical and analytical support to Comprehensive Test Ban Treaty negotiations, and the establishment of nuclear technology programs designed to assist in the fulfillment of U.S. obligations for peaceful nuclear cooperation. Our program will continue to support the goals of the NPT.

However, with all of these accomplishments, there is still much more to do. In fiscal year 1996, we must accelerate our efforts to protect fissile materials and redirect nuclear expertise in the former Soviet Union to peaceful projects. The Department will expand its efforts to end the civilian production and use of weapons-usable fissile materials through promotion of alternative energy sources, the Reduced Enrichment for Research and Test Reactors (RERTR) Program, and nuclear material purchases. Also in fiscal year 1996, the Department will continue its efforts to monitor U.S. and Russian inventories of plutonium and highly enriched uranium from weapons dismantlement through inspections and other activities that make dismantlement transparent and irreversible.

Among other measures, we will advance nonproliferation: by our efforts in North Korea; by continuing support of negotiations of a Comprehensive Test Ban Treaty and an international fissile material cutoff convention; and by facilitating International Atomic Energy Agency inspections in the United States. Reflecting this need to accelerate our nonproliferation efforts, our budget for fiscal year 1996 is increased by more than $86 million over fiscal year 1995.

Our unique expertise in support of national and international nonproliferation policies is augmented by our efforts to develop more effective, cost-efficient safeguards and security of the DOE complex. Over the past year, we have reduced department wide safeguards and securities costs by 12 percent through consolidation of sensitive holdings (e.g., nuclear material), elimination of redundancies, effective use of state-of-the-art technology, reduction of security clearances because of the Department's changing missions, and improved safeguards and security planning. All major safeguards and security reductions are subjected to thorough vulnerability analyses to assure that they do not compromise security. We are learning to meet the security challenges of today with less, and are successful in this endeavor.

We are also spearheading the Department's openness initiative, improving the sense of trust held by our customers—the American people. This includes declassifying information about the Department's activities and improving access to the Department and its facilities and without compromising national security and consistent with nonproliferation concerns. Last year, we declassified approximately 110,000 pages of previously classified information. We developed an on-line capability for the public to gain access to the Department's declassification actions through the Internet; no longer is the American public left in the dark about what the Department has declassified—now they have the capability for instant information.

Finally, the Office of Nonproliferation and National Security seeks to improve the Department's emergency response capability. Our primary responsibility in this area is to provide facilities and/or analysis for the management of emergency situations affecting national or regional energy supply and demand, nuclear materials or weapons, or events which threaten DOE facilities or personnel or where DOE assets can contribute to recovery.

The office has recently gained ownership of the Liquified Gaseous Fuels Spill Test Facility which is the only facility in the country authorized to release hazardous materials in the open atmosphere. This facility allows us to improve training to address any accidents at DOE sites and also provide a facility for developing and testing equipment to detect, monitor, and verify proliferant activities of other nations in support of our national goals.

BUDGET REVIEW

The following table summarizes the fiscal year 1996 budget request from the Energy and Water Development Appropriation as compared with the fiscal year 1995 adjusted appropriation:

[Dollars in thousands]

Appropriation/Activity	Fiscal year		Change
	1995	1996	
Other Defense Activities:			
Proliferation and Verification, Research and Development	$226,037	$226,142	$+ 105
Arms Control and Nonproliferation	76,799	162,364	+ 85,565
Intelligence	43,061	42,336	– 725
Nuclear Safeguards and Security	88,816	89,516	+ 700
Security Investigations	33,399	33,247	– 152
Subtotal, Other Defense Activities	$468,112	$553,605	$+ 85,493
Emergency Management (Weapons)	17,336	20,056	+ 2,720
Subtotal, Atomic Energy	$485,448	$573,661	$+ 88,213
Use of Prior Year Balances	– 11,210	– 13,000	– 1,790
Congressional Budget Request	$474,238	$560,661	$+ 86,423

The Nonproliferation and Verification Research and Development budget request for fiscal year 1996 reflects a slight increase. We recognize that reducing the nuclear danger is a vital interest to the United States and the Department of Energy has a critical role to play in that effort. However, we must balance these duties with the need to reduce Government spending—even on high-priority items such as this. As a result, we have continued to increase the focus of our technology development program on detecting proliferant activities. We are also working toward eliminating duplication of effort between agencies and within DOE, improving coordination between sponsoring agencies, streamlining operations and generating a meaningful cost savings.

Overall, the Arms Control and Nonproliferation budget request increases by $85.6 million. Most of this increase is concentrated in materials protection, control and accounting including cooperative laboratory-to-laboratory and government-to-government programs with Russia for the establishment of effective Russian nuclear material security systems and export controls; cooperations with GAN, the Russian nuclear regulatory agency, to develop a nuclear tracking system; and the Industrial Partnering Program. This investment in preventing the possible spread of nuclear material and expertise is modest compared with the possible costs and consequences of inaction.

The Intelligence budget request for fiscal year 1996 reflects a modest reduction from the previous year's appropriation. The request will provide for timely, high-impact analysis and reporting on the proliferation implications of selected nuclear weapons states' programs, emerging nuclear proliferants, nuclear suppliers, and global impacts to the U.S. energy security.

The Nuclear Safeguards and Security request shows a slight increase over the fiscal year 1995 appropriation. It reflects modest increases for technical and engineering support to field offices in the implementation of safeguards and security policies and procedures, modernization of automated office support at headquarters, and increased use of emerging technologies for enhancements to physical security and materials control and accountability capabilities which aid in reducing the overall costs of security. The increase also allows for accelerated review of technical classification guidance and additional training for derivative classifiers.

The Security Investigations budget request reflects a slight decrease as a result of reducing the numbers and levels of active security clearances by requiring the employing office to provide full justification for each background investigation requested.

Finally, the Emergency Management budget request for fiscal year 1996 increases by $2.7 million from the previous year. This increase reflects the intra-Departmental transfer of the Liquefied Gaseous Fuels Spill Test Facility and upgrades to the Department's emergency management system.

RECAP

The fiscal year 1996 budget request for the Office of Nonproliferation and National security is $86.4 million more than our 1995 adjusted appropriation. We have been conscientiously seeking new ways to provide greater services for less cost and believe that we can provide significant value-added programming in a cost-efficient manner. The 1996 request, if granted, will allow the Department of Energy to: improve the application of National Laboratory technical and analytical expertise to meet the Nation's nonproliferation requirements; provide efficient, cost-effective safeguards and security; accelerate implementation of the administration's openness initiatives; and provide integrated and coordinated response to incidents affecting departmental facilities or requiring departmental assistance.

Thank you.

Senator KEMPTHORNE. Thank you, Mr. Baker. I appreciate your comments and the work that is being carried out. Dr. Hecker.

STATEMENT OF DR. SIEGFRIED S. HECKER, DIRECTOR, LOS ALAMOS NATIONAL LABORATORY

Dr. HECKER. Thank you, Mr. Chairman, Senator Exon. I also have a statement that describes our programs in some detail. I will just make some summary comments and will not repeat what has been said before.

Senator KEMPTHORNE. I appreciate that.

Dr. HECKER. Mr. Chairman, you raised very serious issues in your opening comments and I share many of your concerns, especially in today's world, where we cannot test. We are not replacing the old systems with new ones. The production complex to a large extent is inoperable, and we have lost half of the R&D people associated with nuclear weapons at Los Alamos over the last 6 to 7 year timeframe.

Now we are changing in how we respond to these challenges to make sure that we are able to take up the very serious challenge that you indicated, and that is through this science-based stockpile stewardship. But it's not only the science-based stockpile stewardship but the idea of enhanced surveillance and then the idea of an integrated remanufacturing and—as I said earlier in the closed session—a kind of smart remanufacturing of nuclear weapons. The laboratories now have to step up to the plate to do that. Also we must deal with the proliferation issues that have been mentioned by Mr. Curtis and Mr. Baker, especially the Russian materials problems.

But most important among my concerns really are the people. The people and the facilities are what make the place and are what is going to be able to allow the country to take care of the nuclear weapons.

I certainly hope that arrest of the slide in the 1996 budget that we have seen in the nuclear stewardship program will help to solidify our people. But, quite frankly, I am really seriously concerned about the lack of investment in our facilities to go with that. Then, as we look at 1997 and beyond, I am personally very concerned about the resource investments.

Finally, I would just say there is a very important aspect of how the non-nuclear programs come into play in leveraging what we do in the nuclear arena. This is that in today's world, without being able to test, being more science oriented, more manufacturing oriented, I have to make sure that my people keep a close interface to the best universities and to the best that industry has to offer. So programs, such as the TTI program, Technology Transfer, that allow us to work with industry and some of the other civilian research programs are really key to maintain the viability of the laboratories so that we can attract and keep the best people to do the job that you indicated at the beginning.

Thank you.

[The prepared statement of Dr. Hecker follows:]

PREPARED STATEMENT BY DR. SIEGFRIED S. HECKER, DIRECTOR, LOS ALAMOS NATIONAL LABORATORY

Mr. Chairman, thank you for the opportunity to testify before this committee. Los Alamos takes very seriously its role in both defense and in science and technology for the future of our Nation, and we stand ready to work with this committee in ensuring United States leadership in both of these areas. There are four points that I would like to make today.

1. *Our nuclear weapons role has changed but not diminished.* Stockpile stewardship—keeping the nuclear weapons in the enduring stockpile safe, secure, and reliable is our central focus today. This challenge differs from our experience base of 50 years because of the moratorium on nuclear testing and lack of new systems requirements that had typically replaced the weapons in stockpile with improved or new weapons. Hence, we are effecting a transition from a nuclear weapons complex that was based on large capacities of the nuclear weapons production complex to one that relies heavily on the capabilities resident in the Department of Energy (DOE) defense laboratories. At Los Alamos, we are stepping up our weapons surveillance activities, developing the capabilities for limited component manufacturing, archiving historical test data, and enhancing our computational capabilities and laboratory experiments to offset the loss of testing. Stewardship is also key to what we consider our broader challenge for the next decade or two—*reducing the global nuclear danger*—which includes how to contain the proliferation of nuclear weapons and how to deal with the legacy of nuclear materials, nuclear waste, and environmental cleanup.

2. *The fiscal year 1996 budget at the laboratories is crucial to retaining the competencies and ability to accomplish this transition.* While the President's fiscal year 1996 budget does arrest the drop in weapons program funding, we are not investing in maintaining the key facilities at Los Alamos that the Nation is increasingly relying upon for a safe, secure, reliable, and affordable stockpile for the future. The escalating costs of our operations, especially our nuclear facilities, aggravated by a historical lack of adequate maintenance and investment in infrastructure, are draining our programmatic funds to the point where we will not be able to stem the loss of crucial talent.

3. *We desperately need the management and oversight changes called for in Appendix B of the Galvin report.* These changes would restore the intent of the government-owned, contractor-operated system that has been eroded by incremental increases in oversight. The changes will be instrumental in allowing us to control the skyrocketing costs of our facilities and operations. We are encouraged by the steps the Department has taken to date to initiate the changes called for in Appendix B of the report.

4. *Today, nonnuclear defense research and civilian basic research and technology done in partnership with universities and industry are crucial to our nuclear defense mission.* Selected programs allow us to use our core technical competencies in the broader national interest to leverage nuclear weapons funding and help to provide a stimulating research environment that allows us to attract and retain world-class research talent to serve the Nation.

A COMPELLING MISSION

Our central mission evolved from developing the first atomic bomb during the Manhattan Project to developing nuclear weapons for deterrence during the Cold War. We accomplished both successfully. Today, the Cold War cycle of nuclear weapons development and deployment has ended, and so our central mission must reflect the incredible global events of the past 5 years. In conjunction with the Department of Energy we define our primary mission as providing the technical foundation to *reduce the global nuclear danger* to ensure a more secure future for our Nation.

Stockpile Stewardship and Management

A central and vital component of *reducing the global nuclear danger* is nuclear weapons *stockpile stewardship*—keeping those weapons that the Nation needs safe, secure, and reliable. Stockpile stewardship also requires that the Nation retains the capability to respond to a variety of uncertain futures. *Reducing the nuclear danger* will also require *stockpile management*—providing the capabilities ranging from dismantlement to reconstituting manufacturing if some weapons need to be remanufactured in the future. Much of the stockpile surveillance, dismantlement, and manufacturing technological expertise will eventually reside only at the laboratories. An overview of our vision of nuclear weapons stewardship is attached to this testimony as an appendix.

Los Alamos has historically been a major contributor to national security through its role in developing and assuring the U.S. nuclear deterrent. We continue that role today, through active stewardship of the weapons systems that will remain in the enduring stockpile and those that are in the process of dismantlement. We are performing pit surveillance for the stockpile. We are developing boost gas technology for implementation on the Trident I warhead and as the tritium storage technology of choice for much of the enduring stockpile. We are on track for our nonnuclear manufacturing responsibilities in neutron tube target loading and detonator production and surveillance and are working toward a demonstrated remanufacturing capability for a limited number of stockpile pits. Finally, we are archiving existing design, engineering, and test data on enduring weapons systems. Each of these activities is a part of our overall role in the Department's stockpile stewardship and management programs.

The stockpile is now being drawn down, but the recently completed Nuclear Posture Review concluded that nuclear deterrence remains central to the security of the United States and that we must hedge by maintaining capability. With the many changes of the last several years, the weapons laboratories' role has evolved to a new and in many ways more technically demanding challenge. They must provide for stewardship of the stockpile without nuclear testing as weapons age beyond their design lifetime, and they must provide a smaller, more economical, and environmentally responsible capability for fabrication and replacement of weapon components. We have been pleased to work jointly with the Department and Dr. Reis in developing a vision of how such an enterprise could look in the year 2010, and in beginning to turn it into a rational plan for the evolution of the Nation's nuclear complex. This vision joins a capability-based deterrence with a right-sized capacity for weapon component manufacture and replacement, at an ultimate real saving to the taxpayer compared to continued reliance on remnants of the Cold War infrastructure.

This enterprise centers on the stockpile stewardship and stockpile management programs. We must have the intellectual capital and technical tools that we will rely on to accurately evaluate and revalidate the performance, safety, and reliability of stockpile weapons, and when necessary judge that an aging weapon or weapon component needs to be repaired or replaced. This same set of expertise and tools must be able to certify that such a repaired or replacement weapon will itself be safe and provide the expected performance. This is the challenge facing the science-based stockpile stewardship program, which provides the science and technology for evaluation and judgments on the efficacy of the enduring stockpile. Under a comprehensive test ban and stringent international nonproliferation regime, these judgments and evaluations must in the future be based on science-based understanding rather than the dramatic and clear validation obtained from a nuclear test. We have, of course, always relied on science and excellence in our scientific expertise as the foundation of our nuclear weapons activities. To answer the challenge now posed to us, however, we must improve our understanding and modeling, and this requires improvements in both our computational and experimental science capabilities. This in turn requires the funding and institutional vitality necessary to keep excellent, experienced people.

The stockpile management component of the enterprise is the fabrication, maintenance, and materials management counterpart of the Stockpile Stewardship Program. This program has responsibility for the many limited-life components that must be periodically replaced, for the management and production of tritium, and for fabrication of the components, as necessary, of nuclear weapons. A key part of these responsibilities is the technology for processing and fabrication of plutonium parts for weapon primaries, which historically had been manufactured at Rocky Flats.

Together, science-based stockpile stewardship and stockpile management will link science, materials, and manufacturing, and the surveillance of stockpile weapons to provide for assurance in the safety and capability of our deterrent. Science-based stewardship will develop the capability for confidence in the stockpile in the absence of a nuclear testing program. Stockpile management will assure the physical capability to maintain and replenish weapon components and systems. The Department has undertaken to prepare a programmatic environmental impact statement on stockpile stewardship and management.

The United States' nuclear stockpile is presently judged to be safe and reliable. However, problems with safety, performance, or reliability have historically been observed and will continue to occur. Weapons change due to material degradation, corrosion, and other factors. Cracks and voids can develop in components. Helium impurities from radioactive decay will build up in plutonium. To illustrate why proper stockpile stewardship and stockpile management are such an important issue for national security, we can look to some of our historical experience. Of the weapon types introduced since 1970, nearly one half used post-development nuclear testing to verify, resolve, or fix problems. Also since 1970, several thousand stockpile weapons underwent major modifications or were hastened toward retirement because of safety or performance concerns. These kinds of problems have been observed in weapons designed by both design laboratories. A particularly clear example, because it involved an unexpected aging phenomenon, was the now-retired warhead for the Poseidon SLBM. The high-explosive in this warhead was discovered to be decomposing prematurely and had to be replaced lest the weapon become inoperable. Because certain materials had become commercially unavailable since the original development program, other modifications were required in addition to changing the high-explosive formulation. Nuclear tests helped ensure that these modifications did not compromise the weapon's performance. This experience also illustrates the concern that identical remanufacturing cannot necessarily be assured and that expert evaluation is needed. In the absence of nuclear testing, the certification of such changes will indeed be a technical challenge requiring a strong base of scientific expertise.

Tritium Supply

Tritium supply is a critical issue for the nuclear weapon stockpile because it decays at 5.5 percent per year and is required for our weapons to operate. The DOE has been in the process of developing a replacement capability since the tritium production reactors at Savannah River were shut down in 1988. To support the projected stockpile level called for in the Nuclear Posture Review, the DOE must have a new operational tritium supply by the year 2011. The requirement date could be moved to as early as 2005 if DOD requirements change. Although new production reactors have been considered, another option, accelerator production of tritium (APT) is under study. The APT option proposed by Los Alamos has become very attractive because of its flexibility to meet reduced tritium requirements at a low capital cost and at the same time maintain the option of increased production, should that be necessary. In addition, APT can be on-line in the year 2005, if required.

The APT project is a national effort begun in fiscal year 1992 with Los Alamos, Brookhaven, and Sandia. Industrial participation from fiscal years 1992–1995 was obtained by competitive bid selection of Bechtel, Grumman, General Atomics, Maxwell Balboa, Babcock and Wilcox, Westinghouse, and Merrick. The design developed and documented by the laboratories and industry has undergone extensive examination by top scientific and engineering panels over the past few months. APT is, in words taken from the 1995 JASON Review ". . . a viable option for meeting U.S. needs for tritium production." Principal advantages of the APT system include its high flexibility to meet demand; very low environmental safety and health impact, because there is no fissile material in the system; and greater public acceptance compared to a reactor.

On March 1, 1995, the DOE released a draft Programmatic Environmental Impact Statement on Tritium Supply and Recycle, and will issue a Record of Decision on the technology of choice by November 1995. There are five potential sites for tritium production: Savannah River, Oak Ridge, Pantex, Idaho National Engineering Laboratory, and the Nevada Test Site. Site selection will be made later in the context of the DOE plan for the entire weapons complex.

Los Alamos' Role

Los Alamos is ready to serve the Nation as a key part of the Department of Energy's vision of capability-based deterrence. *Of the seven systems that will remain in the U.S. nuclear arsenal after the turn of the century, Los Alamos designed and engineered five.* Continuing responsibility for these nuclear weapon systems is a core responsibility of the Laboratory. In addition, many of the key capabilities required for both stockpile stewardship and stockpile management are either principally or uniquely located at Los Alamos.

The absence of the large, capacity-based enterprise in the future places challenging new requirements on the Laboratories, especially Los Alamos, to assure the availability of components needed to maintain that stockpile. One of the responsibilities related to this goal is to demonstrate the ability to produce small quantities of war-reserve components for the existing stockpile. The importance of this demonstration is underlined by the reality that capabilities to produce certain nuclear and nonnuclear components have been shut down or are in the process of planned consolidation. Los Alamos will apply the strengths of its research and development to many of the requirements for the manufacture of materials and components for the enduring stockpile. Manufacturing and certification of components at Los Alamos will be done differently than previously in the complex, but will maintain the same exacting quality standards found in components produced earlier. The difference in Los Alamos' approach to manufacturing lies primarily in three areas: First, manufacturing and research and development activities will be integrated in a seamless fashion that will promote the manufacturing of high-quality, certified components in a cost-effective manner. Second, this integration will provide the means to maintain critical Laboratory skills and expertise while conserving existing resources. Third, manufacturing activities will build on our experiences and partnerships with industry.

These differences are illustrated by a recent manufacturing activity in Los Alamos' Detonation Systems Group. This group received the mission of detonator manufacturing in the DOE's Non-Nuclear Reconfiguration initiative and is tasked with demonstrating manufacturing capability in January 1996. Recently, though, this group was assigned responsibility for producing actuator simulants, not detonators but related electrical devices used to verify aspects of weapon reliability. The simulants were required and produced on an accelerated schedule with only 4 weeks for fabrication, and with limited funds, yet they were manufactured with the formality and demonstrable quality of a level appropriate for a DOE "diamond-stamped" product. This success confirms the key elements mentioned above—seamless integration of research and development and manufacturing using crucial skills available in the Laboratory.

This integration of research and development and manufacturing capability at Los Alamos is a tribute to effective partnerships formed within the Laboratory and with the DOE's Albuquerque Field Office. This partnership enabled Los Alamos to use quality methods and techniques learned from private-sector companies, Motorola and Milliken, to produce these components with controls appropriate to stockpile items, but at a dramatically reduced cost. It is precisely this type of effort that will allow Los Alamos to help maintain the stockpile and retain critical expertise, all at reduced cost to the taxpayer.

Integrating manufacturing capability with R&D tools and expertise is a powerful concept that extends beyond "diamond-stamped" detonator production. Today the R&D and fabrication capabilities of the laboratories are in some cases the only operational means for manufacturing replacement components or supporting any needed stockpile reliability or surety improvements. The details of future manufacturing configurations will be determined in late 1996, following the Stockpile Stewardship and Management Programmatic Environmental Impact Statement. Los Alamos has plutonium component fabrication capabilities, the Nation's only full-service plutonium facility, which can support limited remanufacturing for a smaller stockpile. Our detonator production, tritium processing, and beryllium fabrication facilities assignments support non-nuclear consolidation. Los Alamos' uranium, salt, and high explosive R&D facilities and infrastructure could, with modest added facility investment, meet many of the future component needs of the stockpile. As part of the Advanced Design and Production Technologies (ADaPT) initiative, Los Alamos will also be developing technologies and manufacturing processes to reduce costs and waste and enhance the efficiency of future fabrication of many of these components.

The extensive plutonium research and fabrication capabilities of Los Alamos are essentially unique in the United States. In recent years, Los Alamos has taken on the critical responsibility of surveillance of the plutonium "pits" from stockpiled weapons primaries, and we are pleased to report that these surveillance operations are proceeding successfully. Recently we have begun to recognize that stockpile-focused, science-based stewardship calls for a new and more integrated relationship between fundamental science, computational simulation, and surveillance. In this new relationship, science and simulation will teach us to be more insightful and clever in our surveillance measurements to detect and anticipate problems, as well as being used to interpret surveillance results to evaluate the current and future status of a weapon system. This enhanced surveillance paradigm is essential if we are to determine the proper and sufficient means by which to repair, or otherwise respond to, stockpile issues that could compromise safety, reliability, or performance. This is a lot like the close relationship between clinical medicine and biomedical research. The combination of Los Alamos' research capabilities with its many specialized facilities for plutonium, uranium, high-explosives, and other weapons materials provides an excellent opportunity to grow this kind of synergistic relationship. In fact there is a close parallel between integrated manufacturing that takes advantage of a close interaction between component manufacture and R&D, and enhanced surveillance that creates a close coupling between the scientific base and individual stockpile weapons.

One of the most important challenges in science-based stockpile stewardship is that of developing the computational methods and tools that we will need to accurately evaluate whether the aging stockpile needs repair and to certify any remanufactured or replacement weapons. Los Alamos has been a leader in the development of high-performance computing and in exploiting massively-parallel computer technology for three-dimensional weapons safety analysis and other complex applications. In addition to the core computational activities supporting our stewardship responsibilities, our participation in the Accelerated Strategic Computing Initiative (ASCI) will ensure that the needs of these crucial applications are met by enabling a significant enhancement of the physical and numerical models and by accelerating the development of the relevant technologies to be delivered by the vendor community.

Computational simulations are only as good as the science and physical models that they apply. Validation of modern computer codes against the underground test data archive is essential but far from sufficient. The understanding that we will need for accurate evaluation in the absence of nuclear testing will also require data from a suite of experimental facilities such as the Dual Axis Radiographic Hydrotest Facility (DARHT), the Los Alamos Manuel Lujan Jr. Neutron Science Center (LANSCE), and the Atlas pulsed-power facility, each of which addresses important issues in stockpile performance and reliability.

Hydrodynamic tests—high-explosive-driven experiments for studying primary implosions—constitute the most important above ground, nonnuclear testing capability for nuclear weapons. They allow an integral test of our prediction of these implosions and address the most important issues for the stockpile, the functionality and safety of the primary. The current X-ray radiographic facilities in the United States are insufficient for the kinds of evaluation we will have to make in the absence of nuclear testing. DARHT was initiated to provide the necessary capability in radiographic quality together with a second, simultaneous view from another direction, which will enable three-dimensional imaging so necessary to predictions of nuclear safety and reliability. The construction of DARHT has been halted by court action pending completion by the DOE of an Environmental Impact Statement (EIS) including consideration of alternatives, and the issuance of a Record of Decision. We believe that the enhanced hydrotest capabilities DARHT is designed to provide remain a vital component of the suite of tools necessary to maintain confidence in the nuclear stockpile.

LANSCE, for its part, will provide an opportunity to employ the unique penetrating capability of neutrons to study various materials science issues, including many related to aging. Materials issues can be exceedingly important for predicting compression in supercritical weapon assemblies and for inferring nuclear reactivity in the absence of direct nuclear testing. Neutron resonance radiography will also shed light on high-explosive behavior. Neutron radiography of weapon components, including primaries and secondaries, is an important emerging capability in our long-term plans to assess the effects of aging in the enduring stockpile.

LANSCE will also provide critical data in the area of applied nuclear physics. Recertifications of designs will depend on careful analysis of past data in order to properly attribute performance effects to constituent physical processes. Finally, LANSCE will offer the opportunity to refine our detailed models of the fission process itself. These effects may prove significant in explaining performance-related phenomenology, details that are required in building truly predictive simulation tools.

Much of weapon science depends on detailed study of hydrodynamic or radiation physics, often at higher energy densities than can be readily obtained in high-explosive experiments. The proposed Atlas facility is a 25-million ampere pulsed-power capacitor bank that will enable us to study phenomena associated with both weapon primaries and secondaries with centimeter-scale experimental configurations, at temperatures and pressures high enough to partially ionize the materials. Its unique capabilities will be important for our evaluation of a number of issues related to the aging stockpile, such as the effect of narrow cracks on the implosion and performance of weapon components. We have demonstrated the extremely precise hydrodynamic implosions necessary on the smaller Pegasus facility which is already in use for weapons science experiments within its operational parameters.

Atlas, DARHT, and LANSCE were endorsed by the recent JASON report on science-based stockpile stewardship, and the Department has proposed Atlas for a fiscal year 1996 start. DARHT, LANSCE, and continued experimentation were also explicitly recognized by the Galvin Task Force as needed for stockpile stewardship. These three critical facilities represent the capital improvements needed for science-based stockpile stewardship. Costs for these facilities and projects, as proposed to the Department, are as follows:

Facility	Total (Project) Cost	Comments
DARHT	$124 million (includes first axis, initiated in 1988, $85.6 million, and projected second axis, $38.2 million).	Partially completed. Pending outcome of EIS, earliest completion of first axis in calendar year 1998. Record of Decision may affect costs.
LANSCE	$35 million upgrade to existing facility has been appropriated and is under way.	Annual operating funds of $25 million from Defense Programs will be leveraged by funds from the Office of Energy Research. Additional operating funds will be required.
Atlas	$48 million	Fiscal year 1996 start with completion in fiscal year 1999.

The upgrade to LANSCE, now under way, will also benefit the weapons program directly through its contribution to APT. Los Alamos has been chosen by the DOE to lead the national effort in APT design and development, and LANSCE will play an important role in demonstrating APT technology. If APT is selected as the technology of choice, industry will be brought into the project by competitive bid as early as possible in fiscal year 1996 to participate in the technology demonstrations and to lead the plant design and subsequent construction efforts.

Los Alamos is ideally positioned to lead the national APT effort, having high-power accelerator design and operating experience, high-power beam target design expertise, and a strong nuclear physics and engineering base. In addition, specialized facilities exist in which to assemble and test APT components without costly and time-consuming civil construction. Although the APT design is based on existing technology and well established principles, some technology development to determine the most cost-effective, reliable system is needed. Work to be conducted at Los Alamos over the next 4 years includes effort in three main areas: (1) construction and operation of an engineering model of the first sections of the APT accelerator to demonstrate performance, reliability and operability; (2) demonstration of the tritium production efficiency at LANSCE using the existing accelerator facilities; and (3) further studies of the materials that will be used to construct APT target systems at equivalent beam power densities using the 800-kilowatt beam from LANSCE. I urge the committee's support for this important technology demonstration effort

Nuclear Materials Management and Disposition

Reducing the nuclear danger will require nuclear materials management—assuring the availability or safe disposition of plutonium, highly-enriched uranium and tritium. It is currently projected that a new supply of tritium will be needed by the year 2011. This issue was discussed above under stockpile management. No need for new plutonium or uranium is anticipated in the foreseeable future. The principal concern is one of safe disposition. Currently, many hundreds of tons of these materials exist not only in returned warheads, but also as production scrap, residues, or nuclear waste. We are particularly concerned about the disposition of these materials in the former Soviet Union where these weapons-grade materials represent a significant proliferation danger.

A major challenge lies with the responsible management of nuclear materials, especially plutonium. Reduction of the nuclear weapon stockpile, together with the subsequent dismantlement of weapons and the facilities that formerly produced them, has left the Nation with growing and degrading inventories and decreasing capability to address the problem. At Los Alamos, we have the expertise, facilities, and most importantly, the broad global perspective needed to effectively address this issue.

The driver for nuclear materials management in the United States comes primarily from concern for public and worker health and safety and risk to the environment. The Department of Energy has recently completed a study of the vulnerabilities associated with the deteriorating conditions of plutonium storage across its facilities and has undertaken a program to address shortcomings and assure safe and secure storage pending decisions on ultimate disposition. This important vulnerability study was initiated in part as a result of early efforts by Los Alamos to identify and analyze problems involving plutonium storage containers. Los Alamos researchers were then called upon to train the vulnerability assessment team in relevant material properties and hazards related to plutonium processing and storage. Los Alamos has also taken the lead in stabilizing its own inventories as well as in developing and demonstrating technologies that can be applied to remediate nuclear material vulnerabilities across the complex.

At the Rocky Flats Plant that formerly produced all of the plutonium pits for the nuclear arsenal but is now destined for closure and restoration, 12.9 metric tons of plutonium inventories exist in a spectrum of undesirable material forms that have been largely untouched since production operations were suspended at the site in June 1989. Because of its weapons stewardship role, Los Alamos has the personnel and facilities to help stabilize and secure the plutonium residues at Rocky Flats. The capabilities that we maintain for our weapons stewardship role are also available to DOE to characterize and stabilize plutonium-containing materials at other sites. We consider this effort to be one of the most urgent in the entire DOE complex. In fact, our people have advised and aided Rocky Flats management for a number of years. In the past couple of years, the direct involvement of Laboratory personnel has greatly enhanced assay, examination, and stabilization capabilities that will allow for rapid analysis and reduction of potential hazards at the site.

For example, portable radiography equipment from Los Alamos was used to interrogate a drum of high-plutonium-assay residues that had been mislabeled at the time it was placed in storage. This drum could not be moved because of a suspicion that the material in the drum was so highly pyrophoric that it could ignite and burn spontaneously. The radiography equipment demonstrated that this was not the case and the drum could be moved. Los Alamos employees are currently working with the site contractor personnel to design and assemble real-time radiography equipment of their own.

Some of these materials are in solutions that are starting to leak out of their containment and present a significant risk that needs to be addressed at Rocky Flats. In recent experiments, Los Alamos has used its expertise and facilities to demonstrate that the liquid stabilization approach first proposed would not meet the established criteria and has developed and experimentally demonstrated an alternate approach that meets all the criteria and has been embraced by Rocky Flats. The procedures are being developed and the personnel are being trained at Los Alamos to expedite implementation of this liquid stabilization process at Rocky Flats.

The Nation can further leverage its investment in Los Alamos plutonium processing capabilities for the solution of DOE's pressing plutonium problems, including stabilization and storage of plutonium-bearing materials. Los Alamos has recently demonstrated several technologies that purify and efficiently partition nuclear materials from other waste thereby reducing radioactive waste generation, cost, and risk. For example, we have demonstrated technologies for separating plutonium-containing salts, a big concern at Rocky Mats, from bulk waste. This technology can save hundreds of millions of dollars compared to planned direct disposal in repositories and can have wide applicability across the complex.

In another example, we are examining the possibility of fabricating processing lines in mobile or transportable assemblies. If successful, this approach could minimize transportation risk by moving laboratories for stabilizing residues to sites within the weapons complex, eliminating the need for expensive construction of processing facilities and personnel training at other sites. This approach would provide an optimum method for exporting stabilization technologies to Russia.

Los Alamos is enthusiastic about applying its extensive expertise and special facilities to other key tasks at Rocky Flats and around the DOE complex. At Rocky Flats we are also working on nuclear criticality safety, safe storage standards for metals and oxides, stabilization of other residues, and in support of the environmental restoration program at the site.

The types of plutonium problems we face in the United States at Rocky Flats, Hanford, and Savannah River sites are compounded in Russia by additional concern for the security of the nuclear materials. I will discuss below what Los Alamos is doing to help combat the proliferation concerns in the states of the former Soviet Union by introducing Western nuclear materials protection, control, and accountability standards and practices.

In addition to concerns over military plutonium, the amount of civilian plutonium from nuclear reactors around the world is already several times greater than the military stockpiles of the United States and Russia—and it continues to grow. Most nations view this plutonium as an energy source for their future generations, and they are not about to dispose of it without extracting useful energy. This places an additional burden on the United States to work with the international community to find a long-term solution to the plutonium problem. First, we must stabilize materials such as those at Rocky Flats and similar materials in Russia. Then, we must secure these materials, store them under an international safeguard regime, and develop suitable techniques for disposing of the materials and their waste.

Los Alamos is also investigating new technologies for ultimate disposition of plutonium, such as the development of mixed oxide fuels for partial burning in reactors, and accelerator based transmutation technologies for complete destruction of plutonium. Several of these technologies may also address the larger problem of plutonium in commercial power reactor spent fuel. This is the kind of challenge that laboratories like Los Alamos can help to tackle.

Proliferation Challenges

Reducing the nuclear danger will require *the development of effective nonproliferation and counterproliferation technologies.* We must keep nuclear weapons, nuclear materials and nuclear weapons knowledge out of the wrong hands. The threat of proliferation of weapons of mass destruction poses the most significant risk to our national security today. The defense laboratories are applying their skills to develop technologies for nonproliferation (keeping the materials out of the wrong hands) and counterproliferation (responding to the proliferation threat), and we are working with our former adversaries in Russia to prevent diffusion of nuclear materials and expertise.

Russian Nuclear Weapons

One of the principal proliferation challenges is that related to the nuclear weapons and weapons expertise of the former Soviet Union. The national laboratories are actively engaged with our counterparts in Russia to prevent the diffusion of weapons, materials, and scientists to countries that would represent a proliferation risk. Our interactions with the Russian institutes have two objectives:

- Stabilization of weapons expertise. Russian weapons scientists are an extremely valuable asset to a potential proliferator. By working with these scientists and directing their attention to peaceful, yet scientifically challenging problems, we reduce the likelihood of their emigration or their working for a rogue nation.
- Stabilization of weapons and weapons-capable materials. The shortest routes to proliferation are to obtain a complete weapon, critical weapon components, or materials. We are assisting the Russians to develop and apply technologies and systems to help prevent such a diversion.

Los Alamos is engaged in what are called laboratory-to-laboratory collaborations with Russian nuclear weapons and nuclear energy institutes. These collaborations are aimed at jump-stating work on the two above-mentioned objectives. These collaborations are able to advance productively while more formal government-to-government deliberations are proceeding.

We see these laboratory-to-laboratory efforts complementing those of our governments. The scientific relationships that have been developed with our Russian counterparts have allowed us to make significant and rapid progress. Let me highlight just two examples.

Scientific Exchanges: The first joint scientific experiment involving the nuclear weapons laboratories of the United States and Russia (Los Alamos and Arzamas-16) was performed in September 1993. This has been followed by five others in several areas of basic science. Many publications have resulted, and the interaction receives broad and frequent coverage in the Russian press, helping to blunt concerns over U.S. motives for working in Russia. A number of Russia's core weapons people are now working almost full time on these projects, with the expectation that they will soon be supported to do scientific work, rather than weapons design, by the Russian government.

Materials Protection, Control, and Accountability: Trust developed during the scientific exchanges enabled Los Alamos to put into place and lead a program in nuclear materials control that now involves 5 other U.S. laboratories and 10 key Russian nuclear institutes. Contracts were signed within 4 weeks of funding, and the first major demonstrations occurred within 6 months. The Russians now want to move faster and further than our funding will allow, a contrast to other programs in this area.

Recently, at Arzamas-16, a demonstration of equipment and methods for safeguarding nuclear materials was completed. The demonstration was designed for Russian facilities such as those for nuclear weapons disassembly and storage of highly enriched uranium and plutonium. The best of United States and Russian equipment, methods, and concepts were employed in this work. The demonstration was also designed to give the operators and managers of Russian facilities hands-on experience and familiarity with improved materials protection, control, and accountability methods, which would then be introduced into their operating facilities. These methods are now to be deployed throughout the Russian nuclear weapons complex.

The DOE nonproliferation and arms control program is funded at $76.8 million in fiscal year 1995. In fiscal year 1996 the DOE request of $162 million represents an $85 million increase to capitalize on major opportunities created by the lab-to-lab programs for control of Russian nuclear materials and scientific exchanges. Based on the success of the laboratory-to-laboratory program in the last 2 years, we are now poised to make a major contribution to the safety and stability of Russian weapons, materials, and expertise. This is exciting and important work that I hope will receive the support of this committee.

Verification and Control Technology

Technology: With negotiations underway on a comprehensive nuclear test ban treaty, we face new challenges in verification technology. Our concerns with nuclear testing are no longer focused solely toward the former Soviet Union, but toward the much more complex threat of nuclear tests that could occur in any medium and in any part of the world. The challenge of discriminating among signals that could arise from natural phenomena as well as from nuclear tests of unidentified origin is an extremely difficult one. We are responding to it by studying a suite of monitoring technologies—seismic, acoustic, radiochemical, and electromagnetic as well as satellite-based observation. Meanwhile, to deter proliferation at an even earlier stage, Los Alamos and other laboratories cooperate in the DOE's proliferation detection technology program. This program supports advanced technologies such as laser monitoring of atmospheric emissions, multispectral thermal imaging of suspect areas, and effluent monitoring (soil, water, and air) to detect the presence of potential proliferation activity. Still other contributions to nonproliferation and anti-terrorist efforts come from programs in emergency response, export control, and intelligence analysis. With increasingly huge amounts of proliferation-related data, the unparalleled Los Alamos computing capability will be increasingly important for information integration and management.

Analysis: The intelligence program element provides a mechanism to engage the DOE laboratories in the analysis of foreign nuclear weapon capabilities and trends. For example, estimates of the Chinese nuclear program have been most helpful to national-level decisionmakers. An evolving activity that has received recent notoriety is the illicit transfers of special nuclear materials. The DOE intelligence unit is engaging the national laboratories in helping to assess potential sources, suppliers, recipients and networks. In this era of widespread information regarding nuclear technologies, including weapons, the laboratories also help in assessing potential proliferation pathways and interdiction options.

For over 30 years the DOE national laboratory and U.S. Air Force joint effort has produced a highly successful and cost-effective, satellite-based verification program. Another example is technical support to the International Atomic Energy Agency (IAEA); Los Alamos has been the most consistent and productive supplier of new safeguards technology to IAEA safeguards inspectors monitoring nuclear power facilities for the past 25 years. The weapons laboratories provided experts and technology during the Iraq and North Korea crises—to the U.N. Special Commission in the case of Iraq and to the State Department during the confrontation with North Korea over its nuclear weapon program. Because they draw on the same suite of technical skills, the strong synergism between stewardship and nonproliferation activities must be continued at Los Alamos.

Satellites: Our small satellite program has been very successful in demonstrating the viability of a new approach that allows the design, construction, and launch of satellites using advanced technologies for arms control and verification activities on very short time schedules compared to conventional satellite launch schedules. This program is another good example of how we approach our work. The design and purpose of the program is verification, but the satellites produce information of interest to the astrophysics research community as well.

Counterproliferation

Counterproliferation efforts in the 1990s must focus on threats posed by chemical and biological weapons as well as nuclear weapons. Counterproliferation activities include detecting the spread of such weapons; deterring it through incentives and force; responding with appropriate military and diplomatic tools; and protecting U.S.

citizens, property, and interests worldwide. The Department of Defense is defining the scope of counterproliferation efforts and is integrating its efforts with those of other agencies. Los Alamos has responded to the new counterproliferation initiative by establishing a dedicated counterproliferation office and by expanding its participation in a number of emergency response programs. The new effort at Los Alamos is built around the Nuclear Emergency Search Team (NEST) and Accident Response Group (ARG) programs, both of which are funded by DOE. These teams address the potential need to find and secure nuclear weapons and nuclear materials in unusual circumstances. NEST/ARG-related skills will be expanded to address chemical and biological threats. Thus, the expanded counterproliferation program at Los Alamos will be closely coupled to the existing nonproliferation program.

In support of counterforce options in counterproliferation, we are applying modeling capabilities and techniques developed in our conventional munitions programs to analyze the lethality of fragmentation and hit-to-kill warheads against various threats, including canister munitions that may contain chemical or biological agents. The demonstration of multimode warhead munitions to drastically reduce logistics and strike-planning burdens is also being pursued. These lethal mechanisms are optimized for a wide spectrum of targets from a single warhead package.

The Environmental Legacy

Reducing the nuclear danger also will require that we clean up the legacy of 50 years of weapons production. As the global military threat recedes, it is imperative that we turn our attention and technical tale to remediating the environmental problems in the defense complexes of the United States and the former Soviet Union.

Los Alamos is applying its multidisciplinary staff and dedicated resources to areas of concern including waste minimization, characterization and remediation (including treatment, disposal, and storage), environmental restoration, waste management, and pollution prevention. DOE possesses a number of legacy wastes (hazardous, high- and low-level radioactive, transuranic, and mixed) that are complicated and often heterogeneous in nature. These waste types pose a significant treatment and management challenge. Industry faces similar problems. For example, waste from nuclear medical procedures shares many of the characteristics of mixed waste.

The Galvin Task Force pointed out the opportunity to apply new science and technology to applications in environmental remediation. A larger fraction of the environmental restoration program budget should be allocated to research and development activities. There are many new areas of technology which, if developed further, could yield benefits both in cost and in reduced hazards to the public and the environment compared to current technologies.

Waste management science must evolve to bring under control the large volume of waste and contaminated material that come from restoration and decontamination and decommissioning activities. The following table shows just three areas in which Los Alamos is developing technologies that have application to a number of sites in the DOE complex.

DOE Needs	Los Alamos Technology Areas	Applicable Sites	Industry Partners
Low-level radioactive contamination from soils.	Magnetic separation.	Savannah River, Nevada Test Site, Rocky Flats Plant, Hanford, Idaho National Engineering Laboratory, and military armor penetrator firing ranges.	AWC Lockheed CRADA established with Los Alamos.
Effluent wastes, volatile organic compounds (VOCs), nonarid site VOCs, hazardous-solvent-contaminated machining oils, incinerator/thermal unit off-gas, arid site VOCs, vapor-plume VOCs, solvents, explosives/munitions secondary treatment.	Silent discharge plasmas.	Savannah River, Rocky Flats Plant, Hanford, Los Alamos National Laboratory, Department of Defense, Electric Power Research Institute (EPRI).	EG&G, General Electric, and Westinghouse.
Separation of radioactive constituents and organics from high-level defense waste.	Chemical separations.	Savannah River, Hanford, Rocky Flats Plant, and Los Alamos National Laboratory.	Grumman, General Electric, TRW, IBM, General Atomics, McDonnell Douglas, and Westinghouse.

People and Facilities

To accomplish the mission outlined above, we need outstanding people and the right facilities. Being embedded in a major research university, the University of California, has helped us attract the best talent available. However, the steady decline in nuclear weapons funding since 1987 has jeopardized our ability to keep the best people in the nuclear weapons program and has severely hampered our ability to attract bright young people to work in the program. The precipitous drop in full time equivalent employees in the core nuclear weapons research, development, and test program by a factor of two over that time span has sent a strong and negative message to our staff.

Ensuring that the enduring stockpile will remain safe, secure, and reliable depends on our ability to turn around the grim picture of the past few years. After all, our confidence in nuclear weapons rests not so much on the final product, but in the people. I view it as imperative that the turnaround in the Present's fiscal year 1996 budget is preserved and that within this budget we can spend more of it supporting people doing real technical work and in investing in the upkeep of key facilities. We must turn around the inordinate burden of government oversight that has sapped our strength and morale. The DOE has started some initiatives to make the oversight process more efficient, but we still have a very long way to go.

In addition, we must leverage the nuclear weapons work with other programs to which we can make significant contributions that will simultaneously reinforce the core competencies required for the nuclear weapons program.

People

Of three negative trends in our workforce discussed in testimony last year—the aging of the workforce, a high level of unanticipated early retirements, and the resultant downsizing of the workforce driven by the inability to hire replacements due to shrinking budgets—only the second has stabilized. The Galvin Task Force rightly identified the need to attract and keep skilled people in the program as the most important priority for the management of science-based stewardship of the stockpile.

However, in spite of the continued decline in the workforce due to retirements and budget shortfalls, a recently completed assessment of the skill capabilities at the Laboratory pertinent to supporting science-based stockpile stewardship does hold some good news. Because of the multiprogram nature of the Laboratory, we have been able to retain weapons-skilled people in our workforce by employing them outside the core weapons program in activities that we see as having dual benefit. These activities, related to the civilian science and technology projects, including partnerships with industry, that I will discuss below, have become essential to the support of the core weapons program.

Because of these activities at the Laboratory, we would in a national emergency be able to reconstitute a skilled weapons workforce somewhat larger than that supported by current funding levels. However, this capability will clearly erode over time and as noted last year would be insufficient to fully reconstitute capability in all critical skill areas. Of immediate concern, current and planned funding levels are insufficient to support some of the program activities required for enhanced surveillance of the existing stockpile as well as to complete the transition to a stockpile stewardship program without nuclear testing.

Capabilities

Historically, defense activities have formed the foundation of research and development at the laboratories and have allowed us to make contributions in many other areas of national importance. Shrinking budgets for weapons research and development have now reversed that situation to the point that we now use these other programs to help shore up the technology base needed for the weapons activities. Even with this strategy, however, we are beginning to lose some of the diverse capabilities that would enable Los Alamos to respond to future national contingencies. Some examples: Los Alamos has lost the capability to do high-explosive synthesis and has closed some of its laboratories that perform characterization experiments on explosives. This reduces our capability to address fundamental safety issues and respond to potential future requirements. We have had to close two laser facilities that were intended to perform laboratory experiments relevant to thermonuclear weapons physics. We terminated several advanced development programs that would have improved our experimental capability to offset the loss of testing. All of this was done in order to support urgent near-term requirements. Indeed, rather than expanding our capabilities to maintain nuclear weapons competence in the absence of underground testing—as directed by both the Congress and the President—we have been forced to reduce activity. In many areas we are currently only one or two people deep. Another round of budget cuts will clearly result in additional lost capabilities.

Facilities

In the past, the Laboratory has described a "crisis in facilities" that was putting our ability to ensure the safety and reliability of the Nation's nuclear stockpile at risk. Los Alamos is committed to responsible and flexible stockpile stewardship and support. This requires that the facilities essential for the DOE weapons mission can operate in compliance with all applicable safety, security, waste management, and environmental protection regulations and standards. These facilities house activities and materials that demand increasingly focused attention, with increased operating and capital funding, to ensure that safety and environmental concerns, as well as programmatic goals, can be met simultaneously. Operating these facilities has become very expensive. The current fixed cost for the Laboratory's operating nuclear facilities is in the range of 50 percent to 75 percent of total cost, and rising. Thus the fraction of operations funding available for both programmatic work and necessary improvements in safety systems and procedures, process waste minimization, environmental protection, etc., is decreasing.

With the closure of many elements of the production complex, our facilities will be critical to maintaining the stockpile, supporting dismantlement, and providing the research and development expertise for remanufacturing, should this be required by the DOD and authorized by the President. They will be the only facilities of their kind in the consolidated national complex. For example, Los Alamos currently has the only capability to fabricate plutonium pits—the heart of a nuclear weapon—in the country.

The total cost of maintaining and operating a nuclear facility is being driven by more stringent requirements for demonstrating safety, security, and environmental compliance. For example, at the Laboratory's plutonium facility, the cost of operating the facility, was about 35 percent of that program's budget in 1987. In 1995, these costs, including lost work time by our technical staff, are estimated to exceed 75 percent of the total. The increased costs are being driven by:

- Replacement costs for aging equipment and facilities,
- Increased requirements for formality of operations demonstrating compliance,
- Environmental compliance initiatives required by EPA, State of New Mexico, and DOE,
- Rigorous training required by new standards for personnel qualification,
- Ever-increasing concerns for safeguarding nuclear materials, and
- Increasingly burdensome government oversight in all operational and administrative functions.

A healthy infrastructure is also a requirement for efficient operation of a complex institution such as Los Alamos. That infrastructure is at risk in times of prolonged budgetary pressure because infrastructure investments are not uniquely associated with a specific product. In times of transition, and without sufficient designated investment capital, the infrastructure burden on programs has become heavy and overwhelming. It is time to recognize that these critical government-owned facilities must be upgraded and maintained consistent with current regulatory standards and good business practice. The Galvin task force report pointed out that "If we do not correct this facility situation, the cost of managing and maintaining facilities 'today's way' will soon be so costly that it may substantially consume the laboratories' budget." The task force report goes on to say that management improvements could then significantly reduce the costs of maintenance of renewed and modernized facilities.

While we believe that our facilities are operating safely and present no threat to our employees, the public, or the environment, proper investment is needed now to ensure that they will remain operational and will continue to serve the Nation's defense needs. We are working with the DOE to better estimate what will be required at Los Alamos over the next several years. However, we expect that an investment of the order of $100 million per year in capital, construction, and operating funds will be required.

Conventional Defense

In 1985, the President's Blue Ribbon Task Group on Nuclear Weapons Program Management headed by Judge William Clark concluded that the DOE defense laboratories (Los Alamos, Sandia, and Livermore) should be tasked to serve some of the research and development needs of the Department of Defense in nonnuclear areas. Such work would concurrently benefit the laboratories' competencies for their nuclear weapons requirements. Ten years later, the three DOE defense laboratories have demonstrated the wisdom of Judge Clark's recommendation with many contributions to DOD requirements, especially under the auspices of the joint DOD/DOE munitions program.

As the DOD restructures and consolidates its research and development enterprise today, the Blue Ribbon Task Group's recommendation is more applicable than ever. The DOE defense laboratories can support the DOD laboratories and help extend the shrinking defense science and technology base of the United States. The science and technology base developed for our nuclear and past conventional defense activities are a resource to address the emerging threats of the 21st century. Use of these capabilities by the DOD is an effective way to leverage the investments made in the nuclear weapons program for conventional defense. In turn, conventional defense programs at Los Alamos are a vital part of the Laboratory's portfolio, supporting and strongly complementing its nuclear national security missions. These programs are also a major contributor to our defense science and technology base.

We have organized our defense technologies portfolio based on technology and programmatic platforms to best support new DOD initiatives while meeting current commitments. We are building strategic partnerships with the military services and service laboratories, industry, and academia to support science and technology efforts.

Conventional Weapons Technology

Conventional weapons technology includes the Non-Nuclear Munitions Memorandum of Understanding, technology programs and projects in high-explosives, conventional weapons, lethality, and survivability for DOD applications. The joint munitions program supported by both DOE and DOD has been very successful. It was funded at $24 million in fiscal year 1995, and is scheduled for the same level for fiscal year 1996; this is a program that provides significant leverage and could easily be increased.

One example of this work is the armoring of C–141 aircraft. Based on the capabilities developed in our Armor/Anti-armor program, we were able to design and produce modular kits to retrofit C–141 aircraft with cockpit armor. Five complete sets were fielded within 8 weeks to protect the crews and critical systems of these aircraft as they flew peacekeeping missions in Bosnia. Other examples include new classes of insensitive high-explosives that are far less vulnerable to detonation in accident conditions; the development of new processes for the safe, environmentally sound demilitarization of energetic materials; and new, smart, adaptable warheads for multiple target sets.

Biological Warfare Agent Detection

The Desert Storm campaign clearly identified the inability of U.S. and allied forces to effectively detect and identify biological-warfare (BW) agents as a critical military deficiency. Because of the low level of technology required to manufacture BW agents, and the relative ease with which they may be employed, our military forces could easily be confronted with the potentially catastrophic effects produced by these agents. Los Alamos was selected by DOD to pursue the development of innovative technologies for BW agent detection and identification. Drawing on our interdisciplinary skills in lasers, optics, information technologies, and engineering design, a light detection and ranging (lidar) system, designated the XM–94 by the Army, was designed, built, and tested by Los Alamos in a period of 5 months in 1993. The XM–94 is an order of magnitude smaller in size and weight and has substantially improved operational characteristics, compared to an earlier prototype BW agent detection lidar quickly fielded by Los Alamos during Desert Storm. As part of the DOD Counterproliferation Support Program, Los Alamos will build two military-engineered-and-qualified advanced prototypes based on the XM–94 concept, and transfer the technology to industry for production.

In a closely related activity, Los Alamos has also been tapped by the Army to exploit its expertise in sensors and biotechnology to develop a miniature flow cytometer (a technology that Los Alamos pioneered) for its Biological Integrated Detection System, which provides point detection and rapid identification of BW agents at forward deployment locations. Compared to current, off-the-shelf flow cytometers, the mini-system will represent a significant reduction in system volume, weight, and power requirements; operate in a semiautomatic detection and identification mode; and be designed and engineered for the military environment. This will bring the military's capability significantly closer to its goal of near-real-time, positive BW agent identification. Production beyond the initial test articles will also be transferred to an Army-selected industrial contractor.

Modeling and Simulation

Advanced modeling and simulation capability will allow the our military to "practice" an actual engagement scenario while varying tactics and weapons to determine an optimum approach that minimizes casualties and collateral damage, as well as providing a structured approach to procurement decisions and the evaluation of life-cycle costs.

Simulation is defined as macroscopic systems modeling for requirements, prototyping, procurement, test and evaluation, operations, and training, including man-in-the-loop scenarios. The full utilization of high-performance computing for modeling needs of the defense community, for simulation of agile manufacturing and process control, and for analysis of complex systems involves the use of scalable workstation resources linked effectively with high-performance computers.

Significant results with the 1024-node Connection Machine 5, vectorized codes on Cray machines, and connection to a network funded by the Advanced Research and Projects Agency and the National Science Foundation will enable Los Alamos to make major contributions to the modeling and simulation of defense problems. The object-oriented modeling of systems for global and theater missile defense, corps engagements, and satellite architectures has shown great utility for many defense simulation applications and can provide a framework for modeling advanced technology concepts and evaluating acquisition strategies.

Beams and Sensors

Los Alamos work encompasses particle, laser, and microwave beams and active and passive sensors. The primary emphasis in laser technology at Los Alamos in the near future will be on laser systems that provide frequency-agile sources, both continuously and discretely tunable, for defense-related applications such as biological warfare agent detection, missile defenses, lidar systems, countermeasures, and antisensor devices.

Recent advances in electronics, electrooptics, and computers are facilitating the development of highly capable, compact, active and passive sensors that support a wide variety of DOD applications, such as the use of lidar technology to detect biological agents and theater ballistic missiles and the use of passive threat-warning systems to detect spacecraft, aircraft, and land vehicles. Space environmental sensors and novel low-light level and multispectral imaging sensors developed for nonproliferation and counterproliferation missions are also applicable to DOD needs.

Advanced Concepts

Advanced concept technologies encompass a broad range of projects. Advanced materials for specific applications could be developed that have unique properties such as strong absorption of specific frequencies of electromagnetic radiation. Hypervelocity interceptor missile technologies could enable boost-phase interception of theater ballistic missiles. Other technologies include capabilities and systems that support peacekeeping, low-intensity conflicts, and special missions, those that provide the military and policymakers with flexible options; and novel energy storage systems and beam sources.

Summary

In the past, the DOD put considerable reliance and investment in its science and technology base to provide top-flight weapons systems to our Armed Forces. Examples include stealth technology, precision-guild munitions, and global positioning systems. With reductions in defense budgets and increasing demands for operational readiness, this investment in the future is at risk.

Moreover, recent changes in DOD procurement practices and restrictive interpretation of authorization and appropriations language have had a negative effect on the DOD's and the services' ability to leverage and access the science and technology expertise resident in the DOE defense laboratories. We would advocate new approaches to incorporating the DOE defense laboratories in the DOD science and technology base to ensure the provision of innovative solutions for the future force structure and to help maintain the technological superiority of our defense.

Defense Mission Summary

Los Alamos is well positioned to serve the Nation in this new world. Of the seven nuclear systems that will remain in the U.S. nuclear arsenal after the turn of the century, Los Alamos designed and engineered five. However, the scientific challenge of ensuring the stockpile beyond its design lifetime and doing it without nuclear testing is greater than was the challenge of designing new weapons. At Los Alamos, we have the most complete set of facilities to help support the stockpile of tomorrow. We have a history of technical accomplishments and facilities to help manage the nuclear materials, and we have turned our considerable expertise in chemistry, engineering, and life sciences to addressing the daunting problems of the environmental legacy of the production complex. We are working closely with Livermore and Sandia laboratories to provide the Nation with the best technologies to prevent and respond to the proliferation of weapons of mass destruction. We have made significant progress in developing a cooperative working relationship with its counterpart laboratories in Russia to address worldwide proliferation concerns.

So, *reducing the nuclear danger* will be a compelling central mission for Los Alamos for the foreseeable future. This mission will require that we keep excellent, experienced people committed to these challenges and that we maintain and modernize our facilities. We must also maintain excellence in several core technical competencies that cannot be supported entirely by our core mission activities. Programs in civilian science and technology, whether directly funded or performed in partnership with industry or universities, help maintain the competencies needed by our core defense mission areas while at the same time contributing to broader national goals.

CIVILIAN SCIENCE AND TECHNOLOGY

For this Laboratory to perform its defense missions, the strength and reputation of its scientific and technical capabilities must be maintained. The challenge of assuring a safe and secure nuclear deterrent, particularly in the absence of nuclear testing, requires a diverse scientific and technical environment. In a stringent budget climate this entails access to skills and technologies beyond those that can be supported solely for the national security mission. Civilian research programs now supported by other Department of Energy offices such as the Office of Energy Research, as well as work for other Federal agencies, and partnerships with industry, help support necessary defense capabilities. Further, maintenance of the quality of the Laboratory's work requires that the Laboratory's scientists be integrated into the broader scientific and technical community. The multiprogram nature of our Laboratory must be maintained if we are to continue to perform, much less excel, in our defense mission.

I view work in civilian research and development as being vitally important to the Laboratory. First, there are direct benefits to working in these areas that accrue to the Laboratory. The intellectual challenges bought by civilian research and development often provide the necessary dynamics for development of technology for mission applications. A second reason for the essential character of civilian research and development is the need for the Laboratory to continue to attract the best scientists and engineers. Work in these fields helps provide the level of challenge needed to recruit a world-class staff. I am concerned that we may find it difficult to maintain the competencies necessary for the performance of our core defense mission if that mission is interpreted too narrowly. Civilian research is therefore a strong supporting component to the defense mission of the Laboratory.

Basic Research

Basic research has long been a central feature of work at Los Alamos. It has served to inspire young scientists to come to Los Alamos, and it has helped retain some of our most productive senior people. A healthy basic research program also helps keep a focus on science and enhances the reputation of the institution for excellence. Basic research, exemplified by the first detection of the neutrino by a Los Alamos team in 1956 and our recent research on the mass of the neutrino, is essential to our defense mission. Research in materials using spallation neutrons at the Los Alamos Manuel Lujan Jr. Neutron Science Center (LANSCE) will support the defense mission as well, leading to greater understanding of stockpile stewardship issues, new means for tritium production, and perhaps to new ways to rid the Nation and the world of long-lived radioactive wastes.

The laboratory provides a base of support for many projects in basic research that have direct applicability to our defense mission. Work in theoretical astrophysics has long had close ties to our weapons design capability. Research in the synthesis of novel materials; the interaction between radiation, both nuclear and electromagnetic, and materials; and in the properties of materials under extremes of pressured and temperature has produced direct benefits to our core mission.

One of the most synergistic facilities at the Laboratory for the last 25 years has been the Clinton P. Anderson Los Alamos Meson Physics Facility (LAMPF). As a national user facility, it brings scientists from all over the world to Los Alamos to perform experiments and interact with our staff, and sometimes join as employees. The cross-fertilization that comes from interacting with these visitors is part of what keeps the Laboratory a vital and exciting place.

Neutron scattering is a basic tool for probing the structure and dynamics of condensed matter systems and is complementary to more conventional X-ray diffraction, microscopy, magnetic resonance, and structural probes. The use of neutrons as a probe in biological and materials science is growing worldwide, and the importance of neutron beam research facilities has been established by high level review committees, each stressing that existing U.S. reactors for neutron research are now over 20 years old and that new sources are urgently needed. When the LAMPF accelerator came on-line in 1972, it became a new source of neutrons for research, an activity enhanced again by LANSCE, which stated operating from the LAMPF beam in 1985.

Basic research at LANSCE covers a wide range of topics in condensed matter physics, materials science, chemistry, structural biology, geology, and engineering. Static structure and atomic and magnetic fluctuations are probed in a variety of systems ranging from high-temperature superconductors to macromolecules that control muscle contraction. Scientists at LANSCE have concentrated over the past few years in developing techniques in scientific areas to which neutron scattering has not been applied in the past. As a result, the facility has a number of unique capabilities, including diffraction measurements at high pressure, neutron reflection studies of liquid surfaces, and studies of materials under shear. Neutron radiography has been demonstrated, and this can provide an important non-destructive evaluation technique for nuclear assemblies with microscopic resolution and unique isotopic selectivity.

With the medium-energy nuclear physics national user program ending at LAMPF after fiscal year 1995, neutron research will become the focal activity for the high-power accelerator facility and will become an important element of the Laboratory's stockpile stewardship program. The $35 million LANSCE Upgrade project, currently funded and underway for Phase I, will improve facility availability with a goal of running 8 months per year at 85 percent reliability. Better access to LANSCE will be important to the institutional vitality of the Laboratory, as more scientists from around the world use its facilities and increase contact and collaborations between Los Alamos scientists and their peers from government, universities, and industries.

The DOE's plan to build the Advanced Neutron Source (ANS) reactor at Oak Ridge National Laboratory is shown terminated in the fiscal year 1996 President's budget because of cost. The identified alternative is an *accelerator-driven spallation neutron source,* such as that pioneered at LANSCE and the Argonne National Laboratory Intense Pulsed Neutron Source. However, LANSCE and its sister facility at Argonne are oversubscribed and underpowered with respect to future user demand. The Neutron scattering Society of America, through its Pulsed Spallation Source Committee (PSSC) hosted by Lawrence Berkeley Laboratory, has laid out a roadmap for spallation neutron source development which relies on facilities and expertise at Los Alamos and Argonne national laboratories.

LANSCE can also become a higher-power operational prototype. The 1–MW accelerator provides the only beam near this power level in the United States for target development. For the research community, the prototype facility would be a source of neutrons that is at least equivalent to the reactor at the National Institute of Standards and Technology, and in some cases better than the world's best neutron research reactor, the 57–MW reactor in Grenoble, France. This test bed is projected to cost in the $50–$100 million range and will serve the community well for 10–15 years until the next generation source (5–10–MW range) is on-line. The PSSC recommended the High Power Spallation Testbed at Los Alamos as an important component of the U.S. spallation neutron roadmap and is likely to ratify this decision even with the cancellation of the ANS. Thus the United States can, for a modest investment, develop a facility at Los Alamos that is equivalent to the best neutron source in the world until the major next-generation neutron facility is designed and built, a source that will have both defense and non-defense applications.

Energy and Environment

The Laboratory's capabilities in long-term interdisciplinary research and development, nurtured by our defense mission, can also be applied to other civilian research and development needs, thereby leveraging both investments. I discussed our work for the DOD above as examples of mutual benefit to important national needs that in turn support our core nuclear weapons mission. The same is true for programs in energy and environment. In a broader view, energy security is also an integral part of national security; the potential for economic disruption that dependence on foreign sources implies has been demonstrated more than once.

Per-capita demand for energy can be expected to continue to increase worldwide. While there may be no immediate needs for new energy sources in the United States, development of high-efficiency, low-polluting sources should be pursued more vigorously. The form, value, and efficient use of energy in applications is as important as new capacity; therefore a systems approach to energy production and use needs to be taken. These activities can help sustain the developing world and make our own industry more efficient and cost-effective. More effective energy technologies and integration of raw materials issues with product design and recycling considerations will also work to increase the effectiveness of our industrial base.

These issues are too complex and interwoven to expect industry to find solutions by themselves. Many promising technologies are sufficiently speculative that their development poses too high a risk for any industrial segment. The benefits from such work, however, accrue to the public, not individual firms. Success in these areas therefore requires a strong partnership between the Federal Government and industry, using all the technological resources the Nation has to offer. Work at Los Alamos in a number of areas contributes both to new source exploration and the efficient use of energy.

An early example of this approach was the establishment in fiscal year 1988 of the Superconductivity Technology Centers (STCs) at Los Alamos, Argonne, and Oak Ridge national laboratories. The centers' specific mission is to form partnerships with U.S. industry to expedite the development of high temperature superconductor (HTSC) technology with commercial feasibility. These partnerships are industry driven (that is, they are based on research and development projects of joint interest to a company and the Laboratory) with industry bearing the full cost of its participation. The partnership concept benefits both government and industrial research and development programs and focuses on the timely introduction of practical HTSC devices into the commercial marketplace. The emphasis in developing these partnerships is on power applications of HTSCs, although the Laboratory does respond to strong industry interest in collaboration on electronics applications. Industry's positive response is expected to lead to an expansion of the STC program with increased DOE funding. The Laboratory uses its center as a model for industry/national laboratory partnering by extending the concept to other important strategic technologies.

The Laboratory also participates in the Natural Gas and Oil Technology Partnership program, which encourages the domestic natural gas and oil industry to use the scientific and engineering resources of the DOE laboratories to acquire new technologies for improved domestic natural gas and oil recovery. The domestic industry guides the research and development efforts proposed as part of this initiative. Costs of partnership projects are shared with industry collaborators.

The Advanced Computing Technology Initiative (ACTI), which is a major collaboration with the nine multipurpose national laboratories and U.S. industry, primarily the major gas and oil producers, aims to apply the high-performance computing capabilities at the national laboratories to assist in oil and gas explorations, reservoir performance simulation, and other extraction activities. I discuss this program further when I discuss how our scientists work with industry.

A greater emphasis on fundamental environmental research and development is also needed. Examples in which the Laboratory has demonstrated capabilities include:

- Instrumentation, applied information processing, and monitoring technologies and integration.
- Global atmospheric and climate modeling and measurements; e.g., the understanding of the effect of greenhouse gases.
- Risk assessment considerations and methodologies.
- Modeling of complex industrial and demographic systems, e.g., transportation systems.
- Modeling and simulation of energy and environmental recovery processes.

In the past year Los Alamos has become one of the preeminent institutions in computer modeling of the earth's oceans. The original task was to make changes necessary to run a few ocean-circulation codes efficiently on the massively parallel supercomputers at the Laboratory's Advanced Computing Laboratory. Los Alamos scientists did much more. They made such substantial improvements to the numerical methods and physics that these codes now are ranked as the best in the world. This happened because of the legacy of the nuclear weapons design program. The years of experience with large fluid-dynamic computer codes and the large numbers of scientists expert in fluid flow and nonlinear dynamics, numerical methods, and computer science that the weapons design program has supported were easily able to make rapid strides in this non-weapons effort.

Today the Lab is running the most highly resolved ocean simulation (6–10 mile grid) with complete topography (continental margins, islands, and subsurface topography). Details of ocean circulation compare well with satellite observations. The Arctic Ocean is being included for the first time with sea ice physics. Two different codes are being worked representing two different numerical approaches. Plans are being made to couple one of these codes to a very powerful global atmospheric code offering the possibility of the best coupled ocean/atmosphere simulations of the climate. The use of these coupled models to study the effects of energy development in the Third World, for example the use of soft coal as a primary energy resource in China as it develops its economy, ties directly to our fundamental energy mission.

Similar results have come from the weapons program in the area of global atmospheric studies. In the mid-1980s, laboratory scientists responded to requests for a substantial study of the so-called "nuclear winter" scenario. Much work was being done around the country on this subject, but none of it was conclusive. Los Alamos scientists made substantial modifications to a global atmospheric code originally developed at the NSF-funded National Center for Atmospheric Research. In about 18 months, working with atmospheric scientists from NASA's Ames Research Center, they were able to make fully 3D simulations of the response of the earth's atmosphere to massive loading of black smoke and soot. Their analysis showed the major mechanisms that would come into play, and at the special National Academy of Sciences meeting in Washington, DC, Los Alamos scientists were the only ones able to show such results. A few years later this capability was used again to make predictions—a task done in only 2 weeks—of the effects on global climate from the burning of the Kuwaiti oil fields.

Recent measurements and demonstrations conducted by Los Alamos in collaboration with a variety of other organizations have shown that lidar technology, developed by the Laboratory for verification activities, can be a powerful tool for measuring air quality associated with vehicle emissions. Experimental campaigns conducted in Mexico City, Mexico; Barcelona, Spain; and Albuquerque, New Mexico; have located sources of pollution, tracked the movement of aerosols, and located mixing-layer boundaries as a function of time and traffic conditions.

In a somewhat different category, natural disasters cost the United States over $1 trillion annually. The ability to base real-time decisions on event simulations would significantly reduce the destruction of property and the loss of life. By combining predictive models with adaptive systems that enable the extraction of information from large, often noisy, low-confidence data; understanding the limits of predictability driven by the inherent sources of uncertainty; and by creating an environment that accelerates model building to ensure agile responses to developing conditions, Los Alamos could develop the capabilities to predict the rapidly unfolding future, provide guidance to manage emergencies, and develop strategies to optimize remediation efforts. This grand challenge computing problem would be tractable only at an institution like Los Alamos, where the high performance computing hardware is joined with extensive software, data analysis, modeling, and scientific expertise.

Challenges like these, as with our work in basic research, contribute significantly to the Nation, thereby leveraging the Nation's investment in the Laboratory, and help to support the science and technology base needed to succeed in our defense mission.

Work for Other Federal Agencies and Industry

In addition to the DOE's own programs, work for other Federal agencies and industry, whatever the mechanism, also maintains and strengthens Laboratory capabilities which are required for the performance of its core defense mission while contributing to other national needs.

Work for other Federal agencies and industry represents the principal application of the Laboratory's core competence and varied capabilities to national needs in a broader context and to a broader customer base. At the same time, the Laboratory must maintain its mission orientation and not become a "job shop" for industry or for other Federal agencies.

The Department must recognize that part of its mission is the facilitation of the use of its laboratories by other Federal agencies and by industry. The Department has a trustee responsibility to preserve the competence of the Laboratory as a national resource and should not impede the broader use of Laboratory facilities and expertise through the imposition of arbitrary taxes and added factors.

Department of Transportation: We are supporting the Department of Transportation under the Intermodal Surface Transportation Efficiency Act of 1991 in several ways. We are partners with the State of New Mexico, local universities, and Sandia National Laboratory in the New Mexico Alliance for Transportation Research. This alliance brings the research and development capabilities of the Laboratory to bear on infrastructure issues.

Los Alamos is also being funded by the Federal Highway Administration to develop new modeling and analysis capabilities for transportation system planning. We have developed a systematic approach based on principles of dynamic analysis rather than the traditional functional decomposition of transport systems. The Transportation analysis simulation system (TRANSIMS) architecture uses what is appropriate from the traditional process, while developing new and more powerful methods employing modern and newly emerging computing technologies, software technologies, simulation techniques, and analytical methods for complex dynamical systems.

The most important new capabilities offered by TRANSIMS are the integration of congestion and incident effects analysis, detailed air quality impact analysis, and intermodal systems analysis. A significant difference between TRANSIMS and traditional methods is the incorporation of regional scale traffic microsimulation. Vehicle emissions data produced by the microsimulation is collected for mobile emissions source analyses and verification against atmospheric measurements.

National Institutes of Health: The multidisciplinary nature of the Laboratory and its strong capabilities in physical science and large-scale computing enable its scientists to conduct biological and environmental research programs not possible at academic institutions. The National Institutes of Health have drawn on these capabilities to establish at Los Alamos a number of programs including the National Flow Cytometry and Sorting Research Resource, which makes advanced flow-cytometric instrumentation available to the biomedical research community; the National Stable Isotope Resource, which develops new and efficient methods of incorporating stable isotopes into compounds of immediate use in biomedical research; the Genome Sequence Database, which contributes to an understanding of the role of genes and chromosomes in disease; and the human immunodeficiency virus/autoimmune deficiency syndrome (HIV/AIDS) database, which collects and distributes deoxyribonucleic acid (DNA) sequences and determines phylogenetic relationships.

The National Institutes of Health programs nicely complement the Human Genome Project which is funded jointly by DOE and the National Institutes of Health. Los Alamos has just finished a high-resolution map of chromosome 16 as one of the principal responsibilities of its DOE Center for Human Genome Studies work.

Ties to Industry

Industrial interactions continue to be a key contributor to the scientific vitality of Los Alamos National Laboratory. I view working with industry not as an option but as a business necessity. To carry out our mission of nuclear weapons stockpile stewardship and stockpile management, we will increasingly have to integrate manufacturing and maintenance with research and development. We must learn the best practices of American industry which has made great strides in concurrent engineering and quality manufacturing in the past decade. In addition, we find a great deal of commonality with American industry in technology development—this is especially evident in areas such as high-performance computing, modeling, and simulation; advanced materials and processing; advanced sensors; environmentally-conscious manufacturing; optoelectronics; and chemical processing.

The Laboratory's collaboration with American industry has increased dramatically over the past 5 years. We can credit this increase to the 1989 National Competitiveness and Technology Transfer Act (NCTTA) and the congressionally supported DOE Defense Programs Technology Transfer Initiative (TTI). The 1989 NCTTA provided the vehicle for effective interactions, the Cooperative Research and Development Agreement (CRADA). The DOE TTI program provided the financial support for cost-sharing, collaborative research and development with industry where direct benefit could be demonstrated for DOE Defense Programs as well as for industry. The NCTTA provided sufficiently attractive intellectual property rights to the private sector to make cost sharing interesting to industry. In fact, these arrangements, and the dual benefits that accrue, encouraged the laboratories and industry to collaborate across a broader spectrum of defense programs, not necessarily limited to the TTI program.

At Los Alamos, we have just signed our 166th CRADA; our CRADA contracts now have a total multiyear value in excess of $385 million. The interest from industry continues to outpace our funding levels by factors of 8 to 10. Just as importantly, we are finding enormous excitement among the Laboratory's technical staff for working with industry. We find that by selecting the technology and the industrial partner carefully, we can not only maintain, but enhance, the core technical competencies required for our defense mission. Furthermore, we have several cases where collaboration with industry in an area closely related to defense technologies allowed us to keep critical scientists and engineers in the weapons program.

Let me provide a few examples, to highlight both their contribution to our DP mission and their impact on U.S. industry:

We developed a new acoustic technique called resonant ultrasound spectroscopy at Los Alamos to evaluate material properties of high-temperature superconductors.

That technology has now been further developed through licenses and CRADAs into commercial gear usable for a wide range of characterization. One company is now selling non-destructive testing instruments for applications ranging from improved ball bearing characterization (critical in predicting and improving lifetimes of rotating systems) to improved ceramic oxygen sensors for a major U.S. car company. These same acoustic technologies are now also being used for characterization of weapon pits at one of the Department's facilities. We anticipate that such improved acoustic technologies will be a key contributor to the requalification of weapon components to minimize the need for future production.

The Los Alamos technology base in geophysics and computational modeling has been applied to improved characterization of underground oil and gas reservoirs through improved collection and interpretation of seismic signals and better characterization of the permeability of the underground rock formations. We've further improved this industry's capabilities through work with a major oil field service company to significantly improve the use of well-logging tools. In this latter effort, we applied a class of radiation transport computer codes ("Monte Carlo transport"), developed at Los Alamos to predict the interaction of radiation with materials (important in nuclear weapons design), to improve the accuracy of well logging. Through well-logging, the structure of geologic strata outside the oil well casing can be measured and potentially oil-bearing formations localized. The Director of Research for Schlumberger Doll Research noted that ". . . the improvements will ultimately provide crucial capabilities required to develop new and improved logging tools and more accurate measurement interpretation, which translates into more economic recovery of oil and gas." Our defense mission also benefits directly from the improvements made in the computational physics capabilities and the development of improved user-friendly interfaces for the many Los Alamos applications of radiation transport codes, most of which have weapons applications.

With Amoco Oil Company, we expanded an important defense mission research area, the study of turbulent interpenetrating material flows, and improved our ability to simulate these flows more accurately with massively parallel computers. Amoco, for its part, is now able to design more efficient processing systems for residual oil and heavy crude. Through the new Advanced Computing Technology Initiative (ACTI), we will further expand the development of these approaches. For the industry, this can mean improved recovery by better relating seismic measurements and simulations to the parameters of each reservoir and well hole. ACTI projects also contribute to explosives technology, the speed of simulation codes, and database development. Department missions benefit from improved use of seismic signals to interpret underground disturbances, including clandestine nuclear detonations, and better tools for determining the safety of radioactive waste storage.

With General Motors we have had the opportunity to develop a novel idea for surface treatment of materials based on an invention at the University of Wisconsin. Surfaces of materials such as gears or dies are dated in a plasma generated with equipment that the Laboratory was able to bring together from its fusion research, weapons program, and strategic defense research. This Plasma Source Ion Implantation CRADA with General Motors promises to improve hardness and wear of industrial materials in an environmentally benign process, while concurrently opening up the possibility of improving materials for enhanced nuclear weapons safety and for decontaminating surfaces of nuclear process equipment at sites such as Rocky Flats.

Much has been said about having the DOE laboratories contribute to the competitiveness of American industry. The Galvin Task Force report cautioned that the laboratories should stay within their mission areas in forming partnerships with industry. Our experience over the past few years, drawn principally from the DOE TTI program where dual benefit to defense programs was built in at the planning stage, is that Los Alamos does indeed have much to offer to American industry. However, the real story is just how much the Laboratory has benefited from these partnerships. We have carefully examined our 150 CRADAs and found that all of the TTI CRADAs, which constitute the bulk of the 150, have direct benefits to our defense programs, with most of them greatly contributing to the core competencies required for our core mission of reducing the global nuclear danger.

Over the next few years we see the laboratories integrating their R&D in nuclear weapons stockpile stewardship with manufacturing. To be able to offer the Nation the ability to manufacture whatever will be required in the future without having a large and expensive production complex in a standby mode, we will have to develop agile manufacturing techniques similar to those American industry is developing to stay competitive in a global market place. In the future, small numbers of a variety of remanufactured weapons and/or components will likely be needed, and this will require a highly flexible manufacturing capability with the highest quality assurance standards. Hence, we see future cooperation with industry becoming more focused on providing benefits for the nuclear weapons program. In some cases, we can work cooperatively with U.S. industries to develop manufacturing capabilities that will not only enable future weapon component manufacturing, but also advance the state-of-the-art in the manufacturing sciences crucial to U.S. industry. We have found the CRADA mechanism and the TTI funding channel a very useful way to encourage this truly mutually beneficial arrangement. I encourage the committee to continue its support of this effort.

THE GALVIN TASK FORCE REPORT

In 1994, a task force of the Secretary of Energy Advisory Board on the Future of the DOE National Laboratories was convened under the leadership of Bob Galvin of Motorola. The task force, and in particular its subgroup on national security, spent substantial time on the question of the future of the nuclear weapons laboratories and encouraged the laboratories to take a close look at themselves in new ways. In fact, one of the positive outcomes of the process of the task force is that the laboratory directors now communicate and coordinate their activities more closely than ever before. The report of the task force, released on February 1, 1995, is the result of a thorough examination of all the laboratories. I view the report of the task force more as a beginning than an end. The report will be one of several inputs to the White House National Science and Technology Council as it considers the future of the major Federal laboratories this spring. As indicated by this hearing, Congress is also keenly interested in following up on the report because it deals with programs, budgets, and governance—all areas of great interest to the Congress. Nevertheless, I will reserve my comments on the report primarily to those that directly concern Los Alamos.

We find strong support in the report for the Los Alamos core mission of reducing the global nuclear danger. The task force strongly endorses the need for science-based stockpile stewardship in the absence of underground nuclear testing. Specifically endorsed are the needs to attract and retain skilled scientists and engineers; to enhance surveillance of weapons; to re-analyze previous test data by using advanced numerical simulations; to sustain the scientific process of inquiry through experimentation; to support the Dual Axis Radiographic Hydrotest Facility (DARHT) to continue hydrodynamic testing; to utilize the Los Alamos Manuel Lujan Jr. Neutron Science Center (LANSCE) for neutron radiography; and to support research programs such as advanced computing and accelerator concepts for producing tritium. In addition, the report is consistent with our laboratory playing a strong role in nonproliferation and counterproliferation, the safe tracking and disposition of fissionable materials, and cleaning up the legacy of 50 years of nuclear weapons production.

The issue of civilian control of nuclear weapons activities has been visited and revisited frequently. From the Atomic Energy Act of 1946, civilian control of nuclear weapons research and development has been a bipartisan mainstay of U.S. policy, a policy reiterated in the formation of the Energy Research and Development Administration and the Department of Energy. This suggests that, while the world situation has changed, a transfer of the weapons program to the DOD should not be approached lightly.

In 1985, the President's Blue Ribbon Task Group on Nuclear Weapons Program Management I already mentioned was directed to review the question of fiscal responsibility in the nuclear weapons program. As a result of extensive studies of the costs of the nuclear weapons program, the Task Group concluded that funding responsibilities for DOE's nuclear weapons activities should not be transferred to DOD and that the disadvantages of such a transfer would more than offset any advantages.

The Galvin Task Force came to the same conclusion, finding ". . . *no compelling reason for DOD to manage the national security activities at the weapons laboratories. Indeed the Task Force believes that there is much value at this time in maintaining an independent and technically expert organization to focus on nuclear stockpile issues and to continue to ensure that decisions regarding the safety, control, and stewardship of nuclear weapons are raised to the high policy level that they deserve.*"

The task force also finds that "basic research is necessary to support their core missions . . . that it is necessary to attract the most talented people to the laboratories." The report expresses concern over what appears to have been a significant decline in departmental funding for fundamental research over the past 3 years. I share this concern as I expressed above.

The task force is also supportive of the Department's missions in energy and environment. The report states, "there is a long list of exciting, challenging, and vital areas of research and technology development that constitute the appropriate energy agenda for the laboratories." The task force calls for greater attention to the energy mission by the laboratories in conjunction with collaboration with the private sector. It specifically calls out a need to support industrial ecology. We must demonstrate how Los Alamos can make very special contributions to the Nation's civilian agenda because of the strengths and synergism arising from our defense mission.

On the matter of working with industry, the task force provides some cautions to avoid making economic competitiveness a principal mission of the laboratories. I agree with many of the concerns of the task force, however, I want to ask this committee not to indiscriminately cut back the laboratories' industrial collaborations. As I hope I have already impressed upon you, working with industry allows us to stay sharp technically and to provide leverage for the Federal research investment in our programs and institutions.

The task force was also asked specifically to address the size of the laboratories. It does not recommend closure of any laboratories. However, it rejects some of the current arguments for the need for two competing nuclear design laboratories, calling for consolidation of key nuclear weapons functions at Los Alamos over the next 5 years. These recommendations will have to be reconciled with the Department's Defense Programs vision and roadmap of the future weapons complex.

The task force also stated that it "believes that the national laboratory system is oversized for its current mission assignments." Several contributing factors are mentioned, including current management inefficiencies at the laboratories and the Department, excess capacity associated with nuclear weapons, and politics that make it difficult to downsize or restructure. Although I certainly agree that improvements in governance and a sharpened mission focus for the laboratories will yield significant productivity improvements and will allow for somewhat smaller laboratories, along with significantly fewer government oversight personnel, it is critical that we focus first on function and then on size. The 10 laboratories reviewed by the task force currently constitute approximately one-third of the Department's budget. It is imperative that the Department develop its missions and the roadmaps to accomplish those missions and then size the laboratories accordingly.

For example, the current Defense Programs vision and roadmap anticipates a smaller, less costly overall defense complex in the future. However, to achieve this vision the defense laboratories would have to assume additional tasks within the overall complex. The Department should develop similar roadmaps for energy and environment, cleanup, and science. In addition, work for other government agencies must be strategically incorporated to provide the proper synergy with the Department's missions. Congress can help by encouraging the Department of Energy to take this approach to effectively size the laboratory system.

The report leaves little to the imagination on the subject of DOE's oversight and management of the laboratories with the statement, "the current system of governance of these laboratories is broken and should be replaced with a bold alternative." I applaud taking a fresh look at the governance of the laboratories. Over the years the laboratories have been pushed toward *the Federal norm* in many of their business and operational practices, consequently losing much of the flexibility and independence that were the hallmarks of the government-owned, contractor-operated (GOCO) system of governance.

The corporatization model proposed by the task force has certain initial appeal. However, the versions I have examined so far do not appear as attractive as fixing the GOCO system. The major changes outlined in Appendix B of the report aimed at fixing the GOCO system would go a long way to remedy what the task force saw as "operational inefficiencies and demotivational consequences" of excessive oversight and micromanagement.

I am very encouraged by the Department's response (as outlined in Secretary O'Leary's testimony to the Senate Committee on Appropriations on February 28) in addressing the governance and oversight issues. Such actions, along with developing specific roadmaps for the civilian and science missions of the Department would greatly enhance the value of the Department and its laboratories to the Nation. I urge strong congressional support for such actions.

As to what the laboratories can do, we must continue to improve our operations and business practices. The standards that the Galvin Task Force have in mind are not lower than those practiced now. We must be scrupulous in protecting the health and safety of our employees and the public. We must comply with Federal and State laws and regulations. We must demonstrate responsible fiscal and property management. Management improvements would be targeted to focus on effectiveness and product, not on administrative process. We must continue to benchmark our operations and practices against the best-in-class. Only then can we hope for a world with fewer audits and greater flexibility. Further, we must continue to work together more cooperatively as a system of laboratories, teaming as appropriate with universities and industry to meet the science and technology needs of the Nation.

To sum it up, the task force makes some excellent recommendations on how the Department of Energy and the laboratories can enhance their contributions to the Nation. I view it as a positive beginning for the next phase—making it all happen.

SUMMARY

The great strength of our Laboratory is the quality of the science and technology it is able to apply to its mission of *reducing the global nuclear danger.* Indeed, the Laboratory's identity and international recognition rest upon its sustained excellence in satisfying national needs in science and technology. For its entire existence, the Laboratory has been large enough, with sufficient resources and depth, to carry out its defense responsibilities. I want to reiterate the themes on which I began this testimony.

- We are the caretakers of the Nation's nuclear stockpile, and we fully recognize the responsibility that that mission entails. We also acknowledge nonproliferation, nuclear materials, and environmental cleanup responsibilities.
- We need help to arrest the continuing erosion in our competencies. In addition to strengthening support of our defense programs, we must maintain the facilities needed for our defense mission while preserving the talent base upon which our programs depend.
- We need help from Congress and the DOE to implement the changes called for in Appendix B of the Galvin Task Force Report. Without these changes we will price ourselves out of business.
- We must maintain our nonnuclear defense and civilian research and development activities in order to help maintain the competencies needed for our defense mission and to continue to attract and retain the best people for our core mission.

Los Alamos has served the Nation for 52 years. We are prepared to face the new challenges of a different era. I appreciate the continued support that this committee and its predecessors have given the Laboratory.

[Publication titled, "Nuclear Weapons Stewardship, Los Alamos National Laboratory" will be retained in committee files.]

Senator **KEMPTHORNE.** Dr. Hecker, thank you very much. Dr. Tarter.

STATEMENT OF DR. C. BRUCE TARTER, DIRECTOR, UNIVERSITY OF CALIFORNIA LAWRENCE LIVERMORE NATIONAL LABORATORY

Dr. **TARTER.** As with Dr. Hecker, I think you have identified almost all of the crucial issues in your opening statements. I think that the discussions you have had already and the statements you have heard from Mr. Curtis and Dr. Reis have described the architecture of the plan for, basically, the first post-Cold War plan, which has substance and a sense of reality to it.

I think it is contingent upon all of us to make that into a real plan over the next several months. As I said before in the closed session, I think that will happen.

In my own judgment, there are three essential elements to that plan. Then I will pick up on one integrating theme similar to that of Dr. Hecker's.

I think the three elements have been mentioned, but I will pick them out as individual items. The first is the very aggressive—and this word has not been used—archiving program to transcribe, think about, and understand what we have done that put the weapons that are in the stockpile there, and how we transform that knowledge in a fashion that could be used in the future. Much of that is still word of mouth and not quite so well documented and understood.

I will pick up on the concept of the modern remanufacturing I think to get from where we were with a very large production complex into something which is a very modern way of doing the same job for a much smaller stockpile is going to take some time, some investment, and some learning curve.

I think the product, when you are done, will be quite spectacular in many respects. I will just pick one simple example. At Livermore, for example, we have the AVLIS program, the Atomic Vapor Laser Isotope Separation, funded to do enriched uranium. Much of the technology in that program, which now has become a commercially funded program at Livermore—everything from electron beam welding to vapor deposition—are technologies that can directly go into a modern uranium manufacturing technological complex.

So, as with Dr. Hecker, many of the things we have learned, both from commercial partners and industry, can build a manufacturing complex that is a fraction of the size. It has almost no waste, which created much of the cleanup problem we have.

So I think for all of those issues, getting through this transition and having a plan which is credible, is critical. But I think the product at the other end is the thing we have to go for.

The second item I think has already been mentioned. Without nuclear testing, we have to have tools to do surrogates for that testing.

Computation is at the center of it. I think facilities, such as the National Ignition Facility, DAHRT, and a variety of other aboveground experimental capabilities are essential to be able to simulate what would have been nuclear testing.

A third feature I think is one which Dr. Hecker and I am sure Dr. Hagengruber agrees with, which we all have testified to, which is having both expert people but also committed people. I think one of the strong senses which I hope we all feel, at least coming out of this budget process, is a strong bipartisan support because that is something which, in the last several years in this area, with declining budgets, has been a somewhat shaky thing. So I think you need both the expertise but some sense of commitment toward this new program.

As an integrating theme, Dr. Hecker mentioned the science base of the laboratories. I agree with that. But let me add one more. I think that in the absence of a product, such as a new weapon into the stockpile, or other such identifiable objects, I think the ability to manage the system, both from the DOE and within the laboratories, is a much harder job than it ever was during the preceding number of decades in which we have done this program. I think whether it is the laboratory director or the manager of the weapons program, I think much more conscious management of the people, of bringing outstanding people, of being sure that we have facilities which attract them and then bringing them into contact with all of the stockpile issues in a much more focused way, is important.

So I would add management here, which is normally not a very good word for scientists. But I think that will be critical in the next several decades if you are to get something which provides confidence in the stockpile.

I have two final, short comments.

I very strongly also support Mr. Baker's program in the nonproliferation and related areas. As I said in earlier things, there is no simple technological solution. There are a variety of issues that I have talked about in my written testimony. I think a central aspect of that is their reliance upon the knowledge base in many of the other technologies, particularly the nuclear technologies resident in each of the laboratories.

I think that is an equally important national priority.

Thank you very much.

[The prepared statement of Dr. Tarter follows:]

PREPARED STATEMENT BY C. BRUCE TARTER, DIRECTOR, UNIVERSITY OF CALIFORNIA, LAWRENCE LIVERMORE NATIONAL LABORATORY

INTRODUCTION

I am the Director of the Lawrence Livermore National Laboratory (LLNL). We were founded in 1952 as a nuclear weapons laboratory, and national security continues to be our core mission. In addition, we have major programs in energy, environment, and biosciences. Our permanent staff numbers approximately 7,300, with over 1,000 Ph.Ds distributed over a broad range of disciplines in the physical sciences and engineering.

I am here today to support the fiscal year 1996 budget submission by DOE Defense Programs to pursue its Stockpile Stewardship and Management Plan. The program plans being developed by DOE are cost conscious, take maximal advantage of the special capabilities at each of the three national security laboratories, and begin to make necessary investments in the tools needed for assessment and certification of the stockpile without nuclear testing. These investments include the National Ignition Facility and the Accelerated Strategic Computing Initiative, which are of particular significance to LLNL. I also support the budget submission by the DOE Office of Nonproliferation and National Security, which sponsors our important contributions in the areas of nonproliferation, arms control, and intelligence analysis.

BACKGROUND

During the Cold War the nuclear weapons complex consisted of 10 production sites, the Nevada Test Site, and 3 research and development laboratories: Lawrence Livermore, Los Alamos, and Sandia. This complex developed, tested, and ultimately produced a stockpile of 30,000 weapons deployed on many different types of military delivery systems. The laboratories' role was to design, develop, and test nuclear weapon designs to meet military requirements and to be manufactured at the production sites. In addition, the laboratories maintained surveillance over weapons in the stockpile from production through dismantlement, assessed any safety or performance issues that arose, and recommended appropriate remedial measures. Most of the investment in the complex was in facilities and programs for the manufacture of weapons and for the production of the special nuclear materials and tritium needed in weapons.

During the last 5 years, which marked the beginning of the post-Cold War period, this set of activities has undergone dramatic changes. Under the START I and START II agreements the United States will reduce its nuclear weapons stockpile by nearly 80 percent by early in the next century. Most of the production sites in the complex will no longer be needed, the enduring stockpile will be reduced to eight or nine weapon types, and it will be necessary to develop the technical capability to provide confidence in the stockpile without nuclear testing. And, with rare exceptions, the people who will manage the stockpile in the next century will do so without the benefit of having designed or tested a nuclear weapon for the stockpile.

Driven largely by financial pressures—the budget for the weapons program has been cut to less than half of that at the end of the Cold War—the system downsized rapidly and without clear long-term direction. That changed completely over the past 18 months through integrated efforts in the Department of Energy (DOE) to develop a Stockpile Stewardship and Management Plan that will take us well into the next century. In addition, the level of the Department's efforts directed at stemming nuclear proliferation increased, and important new initiatives such as the counterproliferation program in Department of Defense (DOD) were begun.

As a starting point for post-Cold War planning, the DOD's recent Nuclear Posture Review reaffirmed the importance of nuclear weapons for the security of the United

States and set the requirements for the DOE. In addition, Congress and the administration provided an overlying set of fiscal realities that put strong constraints on the way in which DOE could do its job. Our principal mission responsibilities in this new world are:

- *To ensure the safety, security and reliability of the nuclear weapons stockpile.* During the Cold War, modernization programs limited stockpile aging, and nuclear testing assured weapon performance. Now, no new nuclear weapons are being designed or produced, and nuclear testing is not an option for validating the performance of aging weapons. The President has directed us to find new ways to retain confidence in the nuclear deterrent.
- *To provide expertise and technology to support arms control policy development, arms control verification, and intelligence assessments of nuclear weapons activities worldwide.* During the Cold War, the emphasis was on policy support and verification of bilateral arms control. Now, the danger of nuclear proliferation is of growing importance. The laboratories are being called upon to support burgeoning efforts on transparency and confidence-building measures, nuclear materials monitoring and control, and detection of and measures to prevent nuclear proliferation.

Both of these national security mission responsibilities are technically demanding and require husbandry of the scientific and engineering excellence at the laboratories that the nation has relied on throughout the nuclear age. I will discuss each of these two mission responsibilities in turn, with a focus on the new elements that appear in the plan for fiscal year 1996 and a description of Livermore's role. I will close with a short summary, emphasizing those aspects of the program that are particularly vital to the health of and morale at the Laboratory.

STOCKPILE STEWARDSHIP AND MANAGEMENT

The DOE Stockpile Stewardship and Management Plan

The Assistant Secretary for Defense Programs is leading the Department, its three national security laboratories, and other sites in the weapons complex, in developing the DOE Stockpile Stewardship and Management Plan. This long-term plan, when completed, will provide a roadmap based on the requirements set forth by the DOD and will reflect stringent fiscal realities. Current capabilities and facilities, requirements, and cost efficiency combine to drive the overall architecture of the plan and to define necessary long-term investments. Additional efforts are required to complete the plan.

The Stockpile Stewardship and Management Plan calls for radical changes in the way we do business, both to cut costs and to adjust to new circumstances: fewer weapons, fewer types of weapons, no production of new types of weapons, an aging stockpile, and no nuclear testing. It is organized around three major elements to support a small stockpile of weapons:

- *An enhanced surveillance program to understand and predict the effects of aging.* An enhanced surveillance program includes efforts to develop a modern nonnuclear experimental data base for stockpiled weapons and to make archival data more accessible and useful to stockpile stewards. It requires an expansion of current surveillance efforts, an active preventive maintenance program, a focused archival program, and strong supporting capabilities in physics, engineering, and chemistry and materials science.
- *A small, efficient manufacturing capability to refurbish and replace aging and defective components.* Since specific problems that may arise in warheads are difficult to predict, the production facilities of the future must be agile and highly capable, yet affordable. Choices of production technologies will emphasize flexibility and will utilize modern commercial methods wherever possible. Because the stockpile of the future will be much smaller, the focus will be on capability, not capacity.
- *A revalidation process—backed by a set of new experimental tools—to support high-confidence assessment and certification when issues about stockpile performance occur.* The technical staff at the national security laboratories will need to establish a revalidation process based on independent evaluations and judgments to provide additional confidence and mitigate the effects of the loss of nuclear testing. As the scientific underpinning of this process, they will have to rely on numerical simulation with advanced computer models and above-ground nonnuclear testing in more sophisticated experimental facilities. Science based stewardship will have replaced nuclear testing as the means to assure confidence in the stockpile.

DOE's overall plan, which is still being developed, envisions a much smaller overall complex, operating in a more integrated fashion and drawing on the unique strengths of each site. The goal is to cut costs while preserving required capabilities. It will take over a decade to make the transformation to the very different configuration attuned to the needs of the post-Cold War world. It is anticipated that the three laboratories will take on a more challenging and diverse set of long-term roles as the production complex is further reduced.

Much consolidation has already occurred to achieve a leaner program. We have eliminated unnecessarily redundant facilities and capabilities amongst the laboratories. As further steps to consolidate are taken, necessary capabilities and skills must be preserved, in part by making efficient use of existing investments in facilities and people. It is incumbent on all of the laboratories to seek further cost-effective consolidation consistent with the needs of the program.

For example I anticipate the process may eventually lead to cessation of plutonium work at the Livermore site with LLNL scientists conducting their research and development activities at user facilities elsewhere. Before such a transition can take place, however, it will be necessary to determine the required floor space to cost effectively support all of DOE's special nuclear materials missions—stockpile maintenance, clean-up, material disposition, and research. Then, a plan must be developed which demonstrates cost savings from further consolidation. Finally, there must be a method to provide mechanisms for continuation of LLNL's unique research and development activities. Only after these conditions have been met will it make economic and programmatic sense to seek such consolidation.

The LLNL role in the Stockpile Stewardship and Management Plan

LLNL has worked closely with Defense Programs to develop the DOE Stockpile Stewardship and Management Plan, and we are highly supportive of their efforts to create the necessary scientific and technical basis for stewardship in an era of no nuclear testing. We also agree with their efforts to manage the laboratories as a "diversified research system"—as recommended by the recent U.S. General Accounting Office report *National Laboratories Need Clearer Missions and Better Management.*

Livermore's core nuclear weapons program is a factor of two smaller than it was at the end of the Cold War. As a leaner element of the integrated program, we have sharpened our focus. We have preserved the core competencies necessary to support our broad national security mission and attend to LLNL-developed weapons in the stockpile or being dismantled. We also operate special user facilities that provide unique capabilities to the national program. In addition to a number of important but smaller science and engineering facilities, these include:

- *The High Explosives Applications Facility (HEAF),* which is the most modern facility for high explosives research in the world;
- *The Nova laser facility,* which—until construction of the National Ignition Facility—remains the premiere facility in the world for conducting high energy density physics experiments essential to evaluation of important nuclear weapons issues;
- *The Flash X-Ray facility at Site 300,* which is currently the most capable hydrodynamic test facility in the world;
- *The National Energy Research Supercomputer Center (NERSC),* which serves the computing needs of over 150 energy-research sites throughout the United States and serves as a testbed for development of high-performance computing hardware and software;
- *The AVLIS facility and program,* with most advanced capabilities in the world for conducting research and development on industrial-scale processes involving uranium; and
- *The Superblock,* which contains the most modern facilities in the complex for special nuclear materials research and engineering testing.

Stockpile Responsibilities. Dismantlement, which will continue past the end of the decade, involves many systems for which Livermore retains technical responsibility. In particular, dismantlement of the W48 and W79 artillery projectiles, the W55 SUBROC, the W56 ICBM warheads, the W68 SLBM warheads, and the W71 ABM warheads require significant attention to ensure safe and timely dismantlement and disposition of excess materials.

Livermore's responsibilities for the enduring stockpile include the B83 bomb, the W84 cruise missile and the W87 ICBM warhead. These are the only systems in the inventory with all the modern safety features, and they are expected to endure past their originally anticipated lifetimes. In addition, LLNL retains responsibility for the W62 ICBM warhead which is expected to remain in the active inventory until START II is implemented at the beginning of the next decade. Significant effort is being expended on the surveillance, maintenance, and selective refurbishment of these systems.

As part of our archiving program, we are paying particular attention to these stockpile systems. In addition to archiving past data, we are developing a modern experimental database and computational understanding. Many of the nonnuclear experiments on the systems were done 10–15 years ago. Today, much better techniques are available: penetrating radiography with enhanced sensitivity from a gamma-ray camera, high speed laser illuminated photography, and multi-beam Fabry-Perot velocity measurements. These new data and the understanding which results will form the basis of joint LLNL/LANL revalidation of the safety, security and reliability of all important systems.

Surveillance. We are also working to improve the "science" of enhanced surveillance so that we can better understand and predict the effects of aging on weapons. These efforts are the key to an affordable manufacturing capability because they enable a more systematic refurbishment and "preventative maintenance" program rather than an expensive and high-production-rate replacement program when aging effects are found. Livermore is in the process of establishing an enhanced materials database (using surveillance and dismantlement data) and developing sophisticated computational techniques to better analyze these data. In addition, we are applying advanced techniques like scanning tunneling microscopes and atomic force microscopes to look at the effects of corrosion on an atomistic level.

Other advanced sensors and non-destructive techniques are also being developed—most with industrial collaboration—to enable continuous monitoring of key aging signatures within stockpiled weapons. As an example, we are working with several biomedical companies to develop endoscopic surgical tools and fiber optic visualization technologies. These technologies are being applied to inspect nuclear weapons parts and components in locations that are otherwise inaccessible.

Manufacturing and Refurbishment. LLNL is developing technologies to provide cost effective manufacturing capability to replace aging weapon components or refurbish them to extend their life. This is an urgent need. In the near-term we must be capable of replacing any questionable components to important weapon systems—even as the production complex is being restructured to be consistent with future stockpile needs. We also have ongoing activities to develop life extension options for the W87 so that it may remain part of the enduring stockpile well into the 21st century. In the longer-term we must be able to remanufacture weapons at a modest, but scalable production rate in a low-cost and environmentally benign manner.

In many of our manufacturing and refurbishment efforts, we are making effective use of industrial partnerships to pursue technologies and capabilities needed for nuclear weapons work. I will highlight just a few examples of these partnerships, which focus on agile manufacturing, materials processing, precision fabrication, and non-destructive evaluation. Our program is designed to implement cost-effective technologies developed through industrial partnerships in ongoing surveillance and refurbishment activities at the earliest possible date. In fiscal year 1996 these development projects will continue as part of the nuclear weapons complex-wide Advanced Design and Production Technologies (ADaPT) initiative.

At LLNL we are pursuing the development of "modular" production (and refurbishment) capabilities that are not site specific in their characteristics and generate minimal amounts of waste. Once developed, a few units located at any preferred site in the complex provide an inherent capability to do production at a modest level. Timely development of modules for weapon refurbishment or remanufacture of critical weapon parts both support planned life extension programs and provide a hedge against loss of military capability in case of a discovered problem in a critical weapon system.

A pioneering example of this approach is the LLNL development of pit-reuse capability, which would permit the reuse of old plutonium components if necessary to upgrade safety or fix a problem in a stockpiled weapon primary. In addition, we are developing a precision casting process for plutonium to significantly reduce costs and the waste generation during the manufacture of primary components. This process, which could be transferred to LANL for full implementation, can be applied to rebuild pits destroyed in the current surveillance program. It also can be used for the remanufacture of weapon pits at the end of stockpile life of a system and for the production of new pit designs, should these be required.

We are also developing precision casting and spin-forming techniques to replace the current methods of rebuilding uranium parts destroyed in the surveillance program. Precision casting provides a simplified process that will reduce waste nuclear material and scrap in weapon component production. These efforts draw extensively on the uranium capability developed in the LLNL Uranium Atomic Vapor Isotope Separation (AVLIS) program. With our successful pilot demonstration of production-plant-scale enrichment of uranium for reactor fuel, AVLIS technology is being transferred to the U.S. Enrichment Corporation, which will continue funding on-going research and development of AVLIS at LLNL. We have unique capabilities to pursue technology development of advanced fabrication processes for uranium parts and an experienced staff that has applied modern technologies to industrial-scale uranium operations.

These precision-casting efforts also make use of partnerships with industries, such as aerospace, that have similar production technology needs. Working with partners with considerable casting experience, LLNL has been developing a computer code that can predict, with accuracy, the final shape and strength of cast-metal parts, as well as problems (e.g., deformation, porosity) that might be encountered during manufacturing. We are also partnering with Alcoa to produce a computer code for simulation of the fundamental metal forming processes in casting, forging, extrusion and rolling. The code provides LLNL both an important tool for research and development of advanced manufacturing processes for weapon components and ideal simulation software for studying the response of weapon systems to severe abnormal environments (e.g., impacts, fuel fires).

LLNL has the capability to assume responsibility for synthesis and formulation of high explosive materials and fabrication of components to support enduring stockpile requirements. There is a unique combination of special facilities, equipment, capabilities, and experience present at LLNL. For the material quantities required to maintain the stockpile, no significant upgrades to facilities would be needed and operations could be carried out within existing environmental, health and safety regulations. The level and type of effort would fall within the scope of work that has been performed at the Laboratory.

The High Explosives Applications Facility (HEAF) and facilities at Site 300—15 miles east of the main LLNL site—are critically important. HEAF is the most modern facility for high explosives research in the world. It meets or exceeds all modern environmental, safety, and health requirements for explosives research, development and production support. At HEAF, we synthesize and formulate high explosives in small amounts, pursue small scale process development work, carry out supporting theoretical and computer modeling efforts, and conduct experiments involving up to 10 kg detonations. Large-scale synthesis, formulation, and test firing of high explosives is done at Site 300.

Our weapon refurbishment activities are focused on the W87 to extend its life to approximately 2030 by enhancing the structural integrity of the warhead. The W87 warhead/Mk21 reentry vehicle (RV) is the leading candidate for a single RV option for the Minuteman III ICBM. Our Life Extension Program (LEP) activities have included flight testing, ground testing, and physics and engineering analysis. We expect the final design will be chosen this year, certified next year, and stockpile refurbishment could begin in 1997 or 1998.

LLNL is pursuing concepts for W87 LEP refurbishment processes and equipment that make use of work stations, modules, and/or transportable vans together with new technologies to reduce waste, floor space, and necessary equipment. This significant engineering program provides an early opportunity to bring together diverse aspects of the Stockpile Stewardship and Management program in a focused activity.

Science-Based Assessment and Certification. Decisions about the stockpile must be grounded in experimental reality and simulated successfully by detailed computer models. At LLNL we operate state-of-the-art experimental facilities for the integrated complex, including the High Explosives Applications Facility (HEAF), the Flash X-Ray facility at Site 300, and the Nova laser system. Additional tools are needed to develop an improved experimental database to enable technical judgments in the future without nuclear testing. Judgments and decisions will have to rely on the science of nuclear weapon performance to assure the safety, security, and reliability of the enduring nuclear stockpile.

The Fiscal Year 1996 Defense Programs budget submission includes three new initiatives that are very important to Livermore and this concept of science baked stockpile assessment and certification. These are the National Ignition Facility, the Accelerated Strategic Computing Initiative, and the Contained Firing Facility.

The National Ignition Facility

The National Ignition Facility (NIF) is identified by Victor Reis as being "the most important new facility" in the Defense Programs budget request for fiscal year 1996. A total of $61 million is requested for the NIF for Title I design activities and related operating expenses. The NIF is a cornerstone of the science-based stockpile stewardship program. It is the only facility that will permit well-diagnosed experiments pertinent to fusion and high-energy-density physics processes which occur after the high explosive is detonated. The NIF is also the critical next step in the development of Inertial Confinement Fusion (ICF) as an environmentally attractive energy source, and it will serve as a user facility for a wide range of fundamental scientific research.

The NIF will consist of the laser system and optical components, a target chamber, and computer control system all in an environmentally controlled building. The laser, consisting of 192 beams to deliver 1.8 million joules and "ignite" small fusion targets, will be the world's largest optical instrument. Its construction will allow America to retain world leadership in ICF. It will advance U.S. high technology industries such as those in optics, lasers, materials, high-speed instrumentation, semiconductors, and precision manufacturing. Because of this impact, the NIF has been endorsed by every major laser and optics industrial organization. Initial operational capability is planned for late 2002.

A laser ignition facility was strongly recommended by the National Academy of Sciences and the DOE Fusion Policy Advisory Committee in their 1990 reports. More recently, the DOE ICF Advisory Committee and the JASON Review Committee, a prestigious academic-based DOD scientific advisory panel, endorsed the NIF. In their July 1994 report, the JASONs said that "The NIF is without question the most scientifically valuable of the programs proposed for the science-based stockpile stewardship program." The NIF was also endorsed by the Galvin Task Force.

In October 1994, Secretary O'Leary announced her approval of Key Decision 1 for the NIF. This followed completion of the Conceptual Design Report in April 1994 and the successful demonstration of Beamlet (a full-scale prototype of a NIF beam). Secretary O'Leary also established a Key Decision 1 Prime process whose goal is to evaluate the consistency of the facility with U.S. arms control and nonproliferation objectives. This is to be completed by August 1995.

I expect the Key Decision 1 Prime outcome to be positive because the pursuit of ICF is very international—including a substantial effort in Japan—and should not impede establishment of a Comprehensive Nuclear Test Ban. The key physical concepts are unclassified and much of the research at the Nova ICF facility at Livermore is conducted in the open with participation by scientists from throughout the world. The NIF will be an even stronger draw for international research projects.

As a user facility the NIF will support research on:

- *National Security.* The NIF will provide access to high-energy density physics regimes essential to evaluation of important nuclear weapons issues. Scientists from all the national security laboratories will be able to obtain nuclear-weapon-related physics data, particularly in the area of fusion and the high-energy-density physics which occurs after the high explosive is detonated for comparison with advanced numerical simulations. These include high-quality opacity data for partially ionized materials, valuable information about the mixing of layers of different materials during implosion, and data that can help us assess the impact of cracks and other abnormalities on weapon performance. The NIF will not enable LLNL or LANL to design new weapons per se, but it will help us evaluate issues for existing designs and improve and test computational models for those designs.
- *Fusion Energy.* The NIF is an essential element in the program for the development of inertial fusion energy for civilian power production. If net fusion energy gain is demonstrated, as anticipated, the NIF will constitute the crucial step toward the ultimate goal of providing energy security for the United States in the 21st century.
- *Science and Technology.* The NIF will produce conditions in matter similar to those found at the center of the sun and other stars. New, well characterized, high-energy-density regimes will be routinely accessible in the laboratory for the first time. The NIF will advance scientific and technical fields such as astrophysical sciences, plasma physics, atomic and radiative physics, hydrodynamics, materials science, advanced coherent and incoherent x-ray sources, nonlinear optics, and computational physics. Scientific progress in those fields will, in turn, provide enhanced understanding of the physical conditions in nuclear weapons.

The NIF should also be a very productive laboratory for new technology. To date, there have been 26 *R&D 100 Awards* bestowed upon researchers at ICF laboratories, including three last year to LLNL staff. In addition, the Laser Program at LLNL has 24 Cooperative Research and Development Agreements (CRADAs) with industrial partners, totaling over $160 million. Optical technology developed for the ICF program enabled a California firm to provide corrective optics for the Hubble telescope, and "radar-on-a-chip" technology developed in the program this year appears to have many revolutionary applications. Already this technology is being adapted for automobile backup warning systems which will be used in some 1997 cars. Additional potential application areas include land-mine detection, health, and surveillance.

Because multiple benefits will derive from a vigorous ICF program in the coming decades, the NIF will attract talented scientists and engineers to contribute to stockpile stewardship. As evidence, one needs to look no further than the selection of the E.O. Lawrence winners in 1995. Two researchers at LLNL, Michael Campbell and John Lindl, just received the Award for National Security for their distinguished leadership in laser-driven ICF—theoretical, computational, and experimental. World-class facilities clearly attract world-class scientists.

The need for the NIF is independent of any siting decisions. However, Secretary O'Leary has voiced her preference for Livermore. LLNL is the natural siting choice because of the large contribution we have made to the advancement of ICF and the development of the laser system to be part of the NIF. LLNL has built six large laser systems since 1974 and each has been completed on budget and performed as designed. The facility would greatly benefit from and contribute to LLNL's existing unique capabilities in lasers, and the NIF would play a key role in the future evolution of the Laboratory.

The Accelerated Strategic Computing Initiative

The objective of the Accelerated Strategic Computing Initiative (ASCI) is to vastly improve the high-performance computing capability at the national security laboratories. Numerical simulation and computer models, benchmarked with historical nuclear test data and results from laboratory experiments, will be the principal tools for assuring stockpile performance in the future. In the absence of nuclear testing, we need more realism in the computer simulations—improved models of physical effects, greater resolution, and use of three spatial dimensions (some problems with no symmetries). To simulate more realistically all of the complex physical phenomena that occur in a nuclear weapon, we need over a thousand-fold increase in computer speed and data storage capacity.

Orders-of-magnitude improvement in capability requires computers with multiple processors working together to rapidly solve a single problem. The use of a machine with more than 100 processors is called massively parallel processing (MPP). To date, massively parallel computing has not advanced as rapidly as it might because of the difficulty in creating efficient, high-performance parallel programs. Obstacles arise from deficiencies in computer (hardware) design and in the development of applications software. To advance the state of the art, the national security laboratories must work with the developers of MPP computers in a multi-year cooperative effort. In addition, information management systems, data storage systems, computer networks, and computer graphics systems all must be improved. These efforts comprise the ASCI, and $45 million in the Defense Programs fiscal year 1996 budget submission supports this important initiative.

High-performance computing has always been central to scientific programs at Livermore so the ASCI is vital to our future. In addition to the classified Livermore Computer Center, LLNL is home for the National Energy Research Supercomputer Center (NERSC). Overall, nearly 10 percent of the Laboratory's annual budget is invested in the development of applications and systems software. We have acquired two MPP computers—a Meiko CS–2 and a CRAY T3D, and we are working on a prototype high-speed network which will interconnect LLNL and LANL to access the resources of both sites. There is a second CRAY T3D and a Thinking Machines Corporation CM–5 at LANL.

We are using the MPP computers to develop three dimensional simulations which include a wide range of structural, high explosive and plasma physics phenomena present in a nuclear device. These efforts require new numerical algorithms and programming techniques to efficiently use the capability of the new machines.

The ASCI is augmented by the Industrial Computing Initiative (ICI), a $52 million CRADA involving LLNL, LANL, and 16 industrial partners. In the 3-year ICI effort, three code development systems will be developed and 13 scientific application programs will be transformed into efficient massively parallel models for use by DOE programs and by U.S. industry to improve productivity and competitiveness. As an example, one of the projects being pursued is environmental modeling of subsurface contamination beneath the Laboratory, a capability which has many other important DOE and commercial environmental applications. These ICI software development activities are breaking the trail for the future of the ASCI.

In addition, LLNL, SNL and LANL are teamed with preeminent industrial organizations like the Semiconductor Industry Association and the National Storage Industry Consortium as participants in both the DOE and DOD programs in advanced information storage systems and advanced lithography for the manufacture of computer chips. This teaming provides efficient leverage of resources from both Departments to provide the high-performance computing capability needed for all national security programs. LLNL's special expertise in technologies pertinent to advanced lithography and information storage enable us to make important contributions to the overall effort.

An example contribution is the National Storage Laboratory (NSL), an effort based at LLNL's NERSC to research and commercialize technologies for high-performance computer storage of large amounts and diverse types of information. This government/industry partnership has achieved over a hundred-fold improvement in storage-system performance and significant improvements in storage-system functionality. NSL efforts have benefited U.S. commercial vendors of high-performance storage systems, provided capabilities for the national information infrastructure, and helped guide the efforts of the national storage-system standards group.

The Contained Firing Facility at Site 300

Hydrodynamic testing is the only currently available way of experimentally testing the implosion phase of a nuclear detonation. These are critical experiments for understanding weapon safety, assessing the performance of weapon primaries, and evaluating the feasibility of approaches for safely disabling a nuclear device. The Defense Programs budget submission includes $16 million in fiscal year 1996 for construction of the Dual-Axis Radiographic Hydrodynamic Test Facility (DARHT) at LANL and $6.6 million for enhancement of the Flash X-Ray facility (FXR) at LLNL's Site 300 to make it a Contained Firing Facility. Containment of the FXR test bed will preserve this important national capability and is a preventive measure to protect against future environmental restrictions.

The investment in the Contained Firing Facility is important because of uncertainties associated with future environmental restrictions and the near term future of DARHT. Construction of DARHT has been halted by court action until completion of an environmental impact statement and the issuance of a record of decision by DOE. Until DARHT comes on line—Autumn of 1998 at the earliest—the FXR facility is the most capable hydrodynamic test facility in the world. It is the best diagnostic tool available for measuring integrated performance of nuclear weapon primaries by nonnuclear testing.

In addition, we are currently upgrading our flash x-radiography capability and making modest investments in the FXR accelerator. The development and use of a gamma-ray camera (replacing the use of film) provides greater sensitivity and resolution at modest cost. It paves the way for being able to obtain a time-sequenced set of images, which would be an important capability for a future more-advanced hydrodynamic test facility.

Industrial Partnerships

LLNL is using partnerships with industry as a process by which we execute our program responsibilities. This is a winning strategy. It benefits the Department of Energy by accessing industrial skills, processes and advanced technology; reducing development costs; and opening up potential commercial sources for needed technologies. This strategy also benefits U.S. industries by providing them a competitive advantage in the global economy through joint public-private development of leading-edge products, materials, and/or manufacturing processes.

We have used Defense Programs Technology Transfer funding at LLNL to establish with industry Cooperative Research and Development Agreements (CRADAs) that directly support our stockpile stewardship and management activities. A large fraction of our industrial partnering efforts either support the Accelerated Strategic Computing Initiative (ASCI) or are part of our Advanced Design and Production Technologies (ADaPT) initiative, which enables us to pursue timely development of needed weapons remanufacturing capabilities. I have previously highlighted some of these activities. Important weapons efforts have been enhanced through such partnership arrangements.

The Importance of Independent Evaluation

Stockpile assurance very critically depends on the process of validation and certification of weapons performance. In the past, validation and certification was greatly assisted by nuclear testing—the final arbiter. In the future it will depend on the judgment of personnel in the program supported by the nonnuclear testing they will be able to perform. It is not surprising that the Galvin Task Force identified "attracting and retaining skilled scientists, engineers, and managers over the years ahead" as the highest priority in stockpile stewardship. The assessments of these scientists must be folded into a management process that will make use of independent evaluations to provide the required confidence in the stockpile.

I strongly believe that such confidence in the performance and safety of the U.S. nuclear stockpile can only result from the independent judgments and evaluations provided by the expertise and capabilities of all of the laboratories in the absence of nuclear testing. We are heading into uncharted territory and must take full advantage of the knowledge and commitment of trained people at each of the laboratories.

Judgments about nuclear weapons issues are particularly complicated because of the uniqueness of the enterprise. For security reasons, only a small community of people have the necessary expertise and access to tools to deal with the intricate classified details of the modern nuclear weapons in the stockpile. In addition, many physics and engineering issues are special to the discipline, such as material properties at extreme pressures and temperatures. Furthermore, we will not have an accurate calibration on how well the new system is working until a few critical decisions have been made, and our customer, the Department of Defense, is satisfied with the results.

Sidney Drell (as Chairman of the National Security Panel of the University of California's President's Council on the National Laboratories) wrote:

> "Livermore's excellence is of great importance, in particular for peer review purposes, as we enter into a comprehensive test ban era and address new challenges to maintaining long-term confidence in the safety, reliability, and effectiveness of our stockpile. . . . We believe there is a need for strong support to maintain LLNL's excellent design and diagnostic capabilities *at this time*. . . . Gradual consolidation of the two laboratories' weapons activities is entirely appropriate with reduced stockpile needs, but we urge caution in assessing more fully their impact before taking specific actions lest we lose important peer review capabilities while they are still needed."

I strongly believe that we must carefully define the process that will be needed, recognizing that it will need to function effectively for the foreseeable future. And we must avoid irreversible decisions before the process is adequately tested.

STEMMING THE PROLIFERATION OF NUCLEAR WEAPONS AND OTHER WEAPONS OF MASS DESTRUCTION

The New Proliferation Danger

The nuclear dangers now facing the United States are more varied and complicated than they were a decade ago. Rather than the monolithic threat posed by the Soviet Union in a bi-polar world, we now must hedge against possible reversal of reform in Russia and address the increasingly serious threat of proliferation of nuclear weapons. President Clinton has stated "A critical priority for the United States is to stem the proliferation of nuclear weapons and other weapons of mass destruction and their missile delivery systems."

Proliferation can occur through indigenous development programs that draw on the increasing availability of nuclear technology and the continuing spread of nuclear expertise. Alternatively, nation-states or rogue subnational units, such as terrorists, can acquire nuclear capability through the theft and subsequent sale of fissile materials or weapons.

To deal with these dangers, we continue to rely on the deterrence provided by the U.S. nuclear arsenal and work to preserve and strengthen the international nonproliferation regime. Stemming proliferation is a challenge to the diplomatic corps, the arms control community, the military, the intelligence community, and the developers of supporting technology. It requires a multifaceted effort by the U.S. Government with activities and programs coordinated among the various agencies that shoulder nonproliferation responsibilities.

DOE and its laboratories provide expertise and technology to support arms control policy development, arms control verification, intelligence assessments of nuclear weapons activities worldwide, efforts to facilitate nuclear weapons dismantlement in Russia and fissile material control, and other nonproliferation and counterproliferation initiatives. In many of these areas, progress is constrained by funding and important milestones could be achieved earlier if additional resources were available.

LLNL Programs in Nonproliferation and Arms Control

I welcome the recognition by the Galvin Task Force that the DOE national security laboratories—and LLNL in particular—have a major, growing mission responsibility in the areas of nonproliferation, counterproliferation, verification and intelligence support. For over two decades, Livermore has played leading role in detecting, characterizing, and countering proliferation activities worldwide. In recognition of this fact, DOE focused its proliferation intelligence activities at LLNL in 1977. Since then our Z-Division has been one of the principal suppliers of broad-based proliferation assessments for the intelligence community. Livermore's past and continuing significant contributions to nonproliferation and our base of nuclear weapons expertise make us especially well qualified to address this emerging threat.

Three years ago, we responded to growing concerns about proliferation by forming a new Directorate at LLNL—the Nonproliferation, Arms Control, and International Security (NAI) Directorate—to better utilize and coordinate the many relevant technical capabilities at the Laboratory. This summer we will co-locate the NAI and the Defense and Nuclear Technologies Directorates in a major new facility. These are synergistic programs and the move will enhance all of our national security efforts for DOE.

Our arms control and nonproliferation activities at LLNL are responsive to two troubling proliferation scenarios. In the first scenario, uncertain nuclear material control, combined with malevolent intent and diffusion of technical know-how, gives rise to a direct threat of terrorist groups or hostile nations smuggling nuclear devices into the United States. Because of the possibility of theft, purchase, or smuggling, political volatility in the former Soviet Union makes the large quantity of Russian-controlled nuclear material and weapons a concern. This threat is compounded by uncertain controls over the huge and growing amount of plutonium from civilian reactors world wide.

Hence, there is a very real possibility that nuclear devices will be smuggled into the United States and detonated, or threatened to be detonated. Moreover, the prospect of terrorists fabricating a nuclear device from illicitly-obtained kilogram-scale quantities of weapons-usable nuclear materials poses a serious threat. In Munich last August, police seized 350 g of plutonium arriving on a flight from Moscow. In December, Czech authorities intercepted a car transiting Prague with almost three kilograms of 88-percent enriched uranium hidden in its trunk. These incidents and others demonstrate that nuclear weapon materials are leaking out and being offered for sale.

In response to this first scenario, we are pursuing activities aimed at:

- *Reducing the exposure of nuclear materials and know-how worldwide.* Our principal activities relate to cooperative threat reduction in the Former Soviet Union, technical support to nuclear arms control negotiations, and technology development for treaty verification.
- *Countering nuclear smuggling* (because nuclear materials might be stolen). LLNL is responsible for operating the DOE Communicated Threat Credibility Center for tracking and evaluating nuclear smuggling incidents.
- *Responding to nuclear incidents* (because terrorists might obtain a nuclear device). LLNL is working on technologies to locate and render safe a terrorist nuclear device.

In the second scenario, proliferation of weapons of mass destruction through indigenous national programs leads to the possibility that such weapons may be considered for use by hostile third-world countries (e.g., North Korea, Iraq, and Iran) and in regions of uncertain stability (e.g., Pakistan-India, Israel-Middle East). How can we detect programs to develop such weapons, characterize their status, and effectively counter them?

In response to this second scenario, we are pursuing activities aimed at:

- *Stemming emerging international nuclear weapons capabilities.* LLNL is one of the principal suppliers of broad-based proliferation intelligence assessments. In addition, we support U.S. activities in international arenas such as UNSCOM and the IAEA.
- *Developing effective detection technologies* (to provide necessary technical capability to assess foreign programs). LLNL develops both remote and unattended onsite sensors for early detection and assessment of proliferant activities, and we develop portable detectors for treaty inspection teams.
- *Suporting DOD's Counterproliferation Program* (because we may not be able to prevent proliferation in all cases). LLNL is pursuing technology activities to provide the DOD near-term deliverables to address chemical, biological, and nuclear weapon threats.

Reducing the Exposure of Nuclear Materials and Know-How Worldwide

Historically, the threat of the theft of nuclear weapons or materials has been contained because of satisfactory control mechanisms. As I mentioned, we are greatly concerned that the instability resulting from the dissolution of the Soviet Union could cause nuclear materials to become available for malevolent purposes. We strongly endorse DOE's efforts to ensure proper nuclear materials monitoring, material protection, control, and accounting (MPC&A) capabilities in Russia. We work closely with LANL and SNL in efforts to assist Russia in these areas.

LLNL is also engaged in many additional cooperative-threat-reduction activities in the Former Soviet Union (FSU) aimed at lessening the likelihood that nuclear materials or know-how are misused. These include: Nunn-Lugar support; efforts to foster Russian warhead dismantlement; work on surplus fissile material disposition options; lab-to-lab cooperative non-weapons projects with Russian nuclear scientists; and support of the Russian highly-enriched uranium purchase agreement.

Countering Nuclear Smuggling

LLNL is responsible for operating DOE's Communicated Threat Credibility Center, which is a unique national resource for tracking and evaluating domestic and foreign nuclear smuggling incidents in support of law enforcement, intelligence, and other agencies. Established in 1978, the Center is linked to DOE's Nuclear Emergency Search Team (NEST). The program draws on trained assessors, laboratory nuclear weapons expertise, and a unique all-source database on illicit nuclear trafficking cases. In support of this effort, we recently initiated a research program to develop methods for forensic analysis of confiscated samples from trafficking incidents. By characterizing seized samples and packaging materials, we hope to be able to shed light on diversion points and transport routes.

Moreover, the country needs a stronger program to counter nuclear smuggling; LLNL is helping DOE develop plans for an enhanced program in this area. Elements would include: better detection equipment at border crossings, airports, and other chokepoints where smuggled material might be interdicted; improved training and equipping of customs inspectors, police, and other officials; and intensified research on how to track down the sources and routes of smuggled material.

Responding to Nuclear Incidents

The United States also needs to reduce the probability that terrorist groups can use a nuclear device should they obtain one or the materials to build one. The NEST program is DOE's program to address the nuclear terrorist threat. We are continuing to develop concepts and hardware that could significantly increase our capability to both intercept and render safe smuggled nuclear material or nuclear explosives. These efforts include:

- *A concept for operational procedures and detection equipment that provide for greatly increased protection for either a military base or a city.* Such a capability would significantly complicate a smuggler's efforts to move nuclear material, even under conditions where it might be presumed that the background radiation would overwhelm the radiation of the threat nuclear material. A promising new concept, which is a spinoff of a warhead counting instrument developed for treaty verification, would provide NEST a much improved capability to use in the field to assess a nuclear threat.
- *Rendering safe nuclear devices.* LLNL has successfully designed and tested small-scale prototypes of a new disablement technique which may be capable of successfully rendering safe all types of nuclear devices. Also, we have invented a radically new device disablement concept which could safely disable explosive devices regardless of the sophistication of the threat.

Stemming Emerging International Nuclear Weapons Capabilities

To stem the efforts of a country attempting to develop nuclear weapons, we need an accurate intelligence-based assessment of its program to most effectively tailor a response. DOE national security intelligence programs executed at LLNL support long-term U.S. Government policies designed to discourage nuclear weapons proliferation and encourage the peaceful use of nuclear technology. Within the intelligence community, we provide unique insight on issues by applying our general weapons expertise and knowledge about specific nuclear weapons designs.

I mentioned earlier the leading role played by LLNL for over a decade. I should also add that although the proliferation threat has increased greatly over the last 5 years, DOE's intelligence budget has been nearly flat. Many countries are being covered with only part-time analysts, and the possibility of missing something important is very real. I strongly recommend increased efforts in proliferation intelligence assessment. We are able to pursue projects in this area very cost-effectively because they leverage existing capabilities of the core weapons program.

LLNL also supports U.S. officials in international arenas such as the IAEA and UNSCOM, for example, in the post-Gulf war inspections in Iraq; in direct negotiation with countries like India, Kazakhstan, North Korea, Russia, South Africa, and Ukraine; and in daily efforts to manage U.S. exports in compliance with federal law and international commitments. DOE nuclear supplier assessments examine the flow of hardware and technology across international and regional boundaries. They help to assure that countries like Iraq comply with U.N. resolutions, meet treaty obligations, and use nuclear technology peacefully. Supplier assessments also improve nuclear related export compliance in Japan and other nuclear suppliers in Europe.

Developing Effective Detection Technologies

LLNL contributes directly to the assessment of foreign nuclear weapon research and production capabilities through development of detectors and remote sensors for early detection of proliferant activities and other signatures. LLNL's efforts, often pursued jointly with other laboratories, rely on our understanding of the target nuclear production processes. The research spans a wide range of sensor technologies, applying the best commercially available capabilities while developing more advanced systems that are needed to better address the problem. Programs are focused on developing the following capabilities, for use in both cooperative monitoring -and intelligence collection scenarios:

1. *Intelligent, unattended, multi-sensor systems to monitor nuclear materials production, transport and storage.* Much of our sensor development is also applicable to law enforcement, counternarcotics, and environmental protection. One example is an application of our unattended ground sensors for controlling illegal immigration. We have designed a new sensor system for the Border Patrol to use over the next decade.
2. *Active and passive multi-spectral imagers and exploitation tools to remotely detect and characterize nuclear production activities.* Our activities in multi-spectral imagery leverage our success in the Clementine program. As you may recall, Clementine was a program to map the moon using very light-weight and cost-effective state of the art instrumentation. The next generation of this "light-sat" program can be used for a wide range of civilian and military missions. The potential nonproliferation application is particularly exciting, but the details cannot be discussed in open session. I would be pleased to brief you on the details during a future closed session.
3. *Robust, reliable techniques for collection and analysis of environmental samples.* LLNL's Forensic Science Center, a new national analytical asset able to characterize ultratrace quantities of almost any organic or inorganic sample, developed and turned over to industry a suitcase-size 50-lb instrument for use by on-site inspection teams supporting the Chemical Weapons Convention (CWC). It uses a light-weight gas chromatograph-mass spectrometer (GC–MS) that can analyze samples extracted from soil, water, or any surface using appropriate chemical solvents. Its long operational lifetime and portability should make it a useful tool for many other applications, including emergency response personnel trying to identify an unknown chemical spill and firefighters identifying potentially hazardous emissions from warehouse fires. Our studies of possible follow-on instruments show that a unit of about half the size of the existing suitcase unit is possible.

Supporting DOD's Counterproliferation Program

Counterproliferation deals with technologies that aid the U.S. military in projecting force in the face of an adversary that possesses weapons of mass destruction. The 1994 DOE/DOD Counterproliferation Memorandum of Understanding designates DOD to have the principal responsibility of addressing the biological weapon and chemical weapon (BW/CW) threat and DOE to have principal responsibility for the long-term technology base needed to address the nuclear threat. LLNL has many technology activities that can lead to near-term deliverables to the DOD to address all three types of threats. For example, LLNL is researching: laser technology to locate and identify specific BW/CW agents on the battlefield; several sensor technologies to locate and characterize hardened targets; and advanced laser and electronic technology to enable satellite sensors to rapidly and accurately locate mobile missile launchers in the battlefield.

Planning for an Expanded Effort

We are in the process of updating our strategic plan for the NAI Directorate, aiming at a more comprehensive program to combat proliferation and terrorist activities, using the full range of capabilities extant at LLNL. We are also examining whether our core competencies in biotechnology and chemistry can constructively contribute support to programs designed to counter other weapons of mass destruction. In the very near future I would like to share our vision of a broader technology program that can leverage our current strengths, capitalize on the collaborative arrangements with our sister laboratories, and provide technology options in this very important area.

SUMMARY REMARKS

The DOE Stockpile Stewardship and Management Plan, as it is evolving, lays out a challenging program for the scientific and engineering staff at the national security laboratories. It represents a major change from the design and testing of weapons to a program in which intelligent surveillance of the stockpile, nonnuclear experiments, and computations form the basis of judgments about the safety and reliability of weapons. There are an analogous set of challenges in the areas of nonproliferation, arms control, and intelligence support. In both situations I agree with the Galvin Task Force that the attraction and retention of skilled people is a top priority.

I believe that the people who will be attracted by this vigorous post-Cold War program will provide the needed scientific and technical vitality. However, this is a demanding effort which requires a long-term commitment by outstanding scientists and engineers. That commitment, in turn, requires the very strong bipartisan support of Congress and the administration. Accordingly, I urge your strong support of the $3.6 billion fiscal year 1996 budget submission for Defense Programs. It constitutes a leveling-off of the budget (larger than fiscal year 1995 but smaller than fiscal year 1994) after having accommodated large post-Cold War decreases. It reflects the need for new investments in capabilities and facilities for stewardship and management of the enduring stockpile. I also urge similar support of the program of the Office of Nonproliferation and National Security, with the exploration of mechanisms for broadened federal support from other agencies in this important area.

Senator KEMPTHORNE. Dr. Tarter, thank you very much. Dr. Hagengruber.

STATEMENT OF DR. ROGER HAGENGRUBER, VICE PRESIDENT FOR DEFENSE PROGRAMS, SANDIA NATIONAL LABORATORIES

Dr. HAGENGRUBER. Senator Kempthorne, Senator Exon, thank you very much for the opportunity to make a few comments.

Sandia recognizes that we are in a period of profound change, which challenges every public institution to honor both its responsibilities and the need to increase our cost effectiveness.

We believe our efforts at Sandia, under the DOE's Science-Based Stockpile Stewardship Program, and the Stockpile Management Programs, reflect a diligent and creative response to those challenges as they apply to the nuclear weapons mission.

It was the intent of our written submission to speak to that, as well as to talk about Mr. Baker's program.

But I would like to make a few comments about the weapons program since this is our yearly opportunity to offer those comments to you.

Our assessment of the current stockpile is it is a reliable, safe, and secure stockpile, and, in fact, it may be among the best that we have had. But it is important to put that into context. It is also one that is entering the most unfamiliar environment that we have ever experienced.

Let me place this comment into context. Sandia, for the Department of Energy, operates the Stockpile Evaluation Program and, in that capacity, tests systems primarily for the non-nuclear components.

During the last 30 years, we have tens of thousands of laboratory and production tests and more than 10,000 systems withdrawn from the stockpile and evaluated. Based on these measurements, we know that there will be, in fact, problems in the stockpile, that will be discovered after production, and that we can predict the repair rate.

For the current stockpile, that is, the START I–START II stockpile, we would predict about two to three significant changes in the stockpile each year, with one to two of those involving significant hardware changes.

We are also seeing aging effects, that is repair rates that increase with time. But this is very new territory for us since the average lifetime of the stockpile was more like 20 years. And as Dr. Smith pointed out, we are entering a time period when we will have the oldest stockpile in history.

While the technologies that went into that stockpile were modern and sound at the time of design, production, and even recent evaluation, we are entering an aging regime with no precedent in the stockpile or from private industry or universities.

The Stockpile Management and Science-Based Stockpile Stewardship Program, put together by the Department of Energy, as it will be exercised at Sandia, is intended to deal with a situation, then, in the context of no testing, no new development, a much less diverse stockpile, reduced budgets, and consolidation.

For instance, our approach at Sandia echoes the approach of our sister labs, with a focus on understanding the basic science of aging and how systems fail, with an understanding how to continually advance surety in our systems when dealing with sunset technologies, especially in areas like microelectronics and information archiving and management.

In the area of stockpile management, we have begun the effort to produce neutron generators at Sandia. We are trying to speed up concurrent engineering, advanced manufacturing to drop our costs, and reduce the floor space necessary to do the required manufacturing.

We support, of course, the computer initiative, the ADAPT (Advanced Design and Production Technologies) initiative for the Department. They are essential to our success.

As Dr. Reis said, we are, in fact, strategizing now that if we treat all weapon components as limited life components, we may better understand how to treat the stockpile. But in the end, the most limited life of all the components are the people and their expertise.

The core nuclear weapons program is the smallest in terms of scientists and engineers that it has been since 1954. And yet, the number of weapons and the complexity of those weapons is at a very high level.

The greatest change that has occurred in the weapons program took place over 20 years ago, from 1967 to 1972, when we dropped over 2,000 people. At Sandia, some 1,500 people have moved from the weapons program to other activities at the lab or have left the lab.

In the 1970s, we broadened the mission and the customer base to expand our work in arms control, safeguards and security, energy and environment, and our work for the Department of Defense. The outputs of these efforts was technology that verified arms control agreements, to allow enhanced recovery resources, to set a standard of protection for nuclear materials that today we share with the Russians. And underlying all of this was a nurturing of the weapon program base by both the needs of these programs and the balanced perspective they engendered.

Today, every weapon lab is a symbiotic system, supporting the weapon technology base at the research end by a diverse set of programs. We have been fortunate in this diversity to bring the best people to the weapons program, to share the cost of test facilities, and the tech base.

We really fully support, Senator, and Mr. Chairman, the Science-Based Stewardship Program and the Stockpile Management Program because they, in fact, get at the very centerpiece of what is stewardship for Sandia, which is to ensure that we have people that believe that public service and excellence in that pursuit is at the heart of the stewardship and weapons program.

Thank you, sir.

[The prepared statement of Dr. Hagengruber follows:]

PREPARED STATEMENT BY ROGER HAGENGRUBER, VICE PRESIDENT, SANDIA NATIONAL LABORATORIES

1. Introduction

Mr. Chairman and distinguished members of the subcommittee, I am Roger Hagengruber, Vice President for Defense Programs at Sandia National Laboratories of the Department of Energy (DOE). Sandia National Laboratories is managed by Sandia Corporation, a wholly owned subsidiary of Lockheed Martin Corporation. It performs scientific and engineering research and technology development in support of DOE's missions in national security, energy, environment, and the basic sciences. Sandia plays a central role in the national security missions of the Department of Energy, having the responsibility for the weaponization of every nuclear weapon in our nation's deterrent stockpile.

I welcome this opportunity to share with you my views on the challenges facing the DOE Defense Programs laboratories during this unique period of history. We have recently witnessed profound changes in national policy and international relationships, the demise of our principal adversary, the fears of proliferation, and the potential for nuclear terrorism. Each of these factors has affected and will continue to affect the character and focus of the traditional nuclear weapons program. At Sandia, we have formidable and enduring responsibilities to assure that the policy options of the United States are never limited by the technology or condition of the stockpile in this period of change. We take those responsibilities very seriously. At the same time, we are sensitive to the fact that the federal budget is under great pressure. Our challenge is strategic: How do we maintain the technical competencies (staff, facilities, and knowledge) required for our DOE national security mission as budgetary resources become more constrained?

We are particularly mindful of the aging processes of the entire system used to support the nuclear stockpile, the people, the technologies, the facilities, and their management. The stockpile of the United States at the present time is safe, secure, and incorporates technology that is sufficient to meet today's standards. At the same time, the stockpile will predictably become the oldest stockpile ever possessed by the United States, as no new weapons are in the design or development stage. Like the human body, the rate of aging of the components of the system will accelerate through time, and a vigorous and vigilant program of surveillance, replacement, and characterization must be maintained.

Therefore, this statement will focus on Sandia's role in the DOE nuclear weapon stockpile stewardship and management program and our strategy for preserving and advancing the technical capabilities we will require for our DOE national security missions in the future, including Sandia's role in nonproliferation, arms control, and intelligence work and our recent interactions with the nuclear weapons laboratories of the former Soviet Union

2. Sandia's Responsibilities in Stockpile Stewardship and Management

Sandia has a central role to play in DOE's stockpile stewardship and management program, particularly in maintaining confidence in stockpile safety and reliability, providing an efficient production complex for the smaller stockpile of the future, and providing for long-range support and surveillance of the enduring stockpile.

Nuclear weapon work at Sandia is carried out in close cooperation with Los Alamos and Lawrence Livermore national laboratories, who are responsible for the nuclear portion (physics package) of the stockpile. Sandia's role in nuclear weapon development is to integrate the nuclear explosive subsystem with many other components (most of which are designed by Sandia) to achieve the desired military capabilities of a weapon. At the same time, we must assure that the extreme requirements for safety and control are achieved. We also certify the required radiation hardening of all non-nuclear DOE components in a weapon system.

Sandia's principal nuclear weapon design and stockpile responsibilities include safing, arming, fuzing, and firing systems; use-control systems; external neutron initiation systems; gas transfer systems; and delivery system interfaces. These responsibilities involve over 90 percent of the parts of a typical nuclear weapon, which might contain more than 6000 parts involving over 100 classes of component types and 200 process streams to achieve manufacture and assembly. In addition, Sandia is responsible for ancillary equipment used by the military services to support nuclear weapon operations in the areas of use control, handling, shipping, storage, and maintenance. We provide field engineering support and liaison with the military services through the entire service life of every nuclear weapon and conduct the system-level stockpile surveillance program for the DOE as well as the specific surveillance associated with Sandia designed components and subsystems. As required, we support retrofitting stockpiled weapons to improve safety and use control or correct a design or age related defect discovered through the stockpile surveillance program. Sandia also develops and maintains capabilities for safe and secure transportation and storage of nuclear weapons and supports the dismantlement of nuclear weapons retired from the stockpile.

Sandia is also mindful of the personal sacrifices and disruptions brought about by the restructuring and reconfiguration of the nuclear weapons production complex. As you are aware, Sandia is also assuming a larger responsibility for non-nuclear component production. While it is clear that DOE expects Sandia to perform an expanding role in this activity, we continue to work with the existing DOE production facilities to arrive at the best solution for the future. The closure of DOE's Pinellas and Mound facilities required that Sandia take on responsibility for producing neutron generators and other specialized components. In the case of the neutron generator assignment, a core complement of over 100 experienced engineers and fabricators are being transferred to Sandia to assure success in this unique manufacturing arena. An additional responsibility of Sandia is assumption of management of quality programs and production procurements for a number of components available through industry that are needed for DOE's stockpile stewardship mission. We are currently on schedule to implement DOE's reconfiguration plan for non-nuclear component production. This reconfiguration will save DOE money and permit production of these components to continue at the laboratories for stockpile needs. We expect our production facility to be operational in 1997.

Surety is an important Sandia responsibility in stockpile stewardship and management. It addresses weapon-safety issues raised by the Drell Panel[1] in their 1990 report, Command and Control issues identified by the Fail Safe and Risk Reduction Study (FARR) of 1992, as well as concerns related to transportation and handling, logistical problems associated with retirement and dismantlement, requirements of a smaller and more flexible stockpile, and increased sensitivity toward environmental safety and health issues. It is Sandia's responsibility to develop the technical means to assure confidence in the surety (safety, security, and control) of nuclear weapons in all environments including the underlying science, technologies, methodologies, prototypical components, and system architectures. The ability to attain this confidence now and in the future for nuclear weapons and other high-consequence activities is of strategic importance to the nation. Sandia's surety strategy is based on the principle that the surety of any high-consequence product or operation must be continuously updated as advances in technology permit. It is unreasonable to assume that the surety technologies presently utilized in the stockpile will be sufficient for the future. What was acceptable twenty years ago is not acceptable today. As technology advances and renders new surety improvements feasible, we will have an obligation to incorporate those new developments.

Our capabilities for the responsibilities of stockpile stewardship and management, (including component design) are science-based; that is, we are dependent upon a deep science and technology infrastructure, including technical expertise and facilities, to support DOE Defense Programs missions. Consequently, it is very important for Sandia to maintain and improve its understanding of the science of complex nuclear weapon systems. We must advance the technologies necessary for nuclear weapon design, engineering, production, certification, and retirement, including warhead dismantlement and the proper disposal of hazardous materials.

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[1] The Drell Panel, formally the *Panel on Nuclear Weapons Safety*, evaluated the safety of U.S. nuclear-weapon systems for the House Armed Services Committee in 1990.

3. Preserving and Advancing Technical Capabilities

It is an erroneous perception that little work remains for the DOE laboratories in nuclear weapon research and development (R&D). Profound changes in the conduct of the program have been imposed: underground nuclear testing is no longer permitted; environmental and worker safety standards now receive added emphasis, plant closures have disrupted the normalcy of support to the fielded product; the structure and size of the nuclear stockpile has changed; and the lack of any new nuclear weapon development presents unusual challenges to the management of the enterprise. However, the technical challenges of stockpile stewardship are formidable and require sustained technical excellence and adequate funding support. At the heart of our technical base is the experience and expertise of our staff. We are addressing this through both a vigorous knowledge preservation activity and configuring our technical stockpile stewardship activities to maximize the opportunity for our young staff to experience the full range of technical challenges associated with nuclear weapons.

As we enter this demanding period of change, we have accumulated statistical data resulting from a long-standing surveillance program, which assured knowledge of the reliability of the stockpile. With a rich history of over 13,000 non-nuclear systems tests, we know that we can expect to identify mandatory corrective actions on a recurring basis, nominally two per year for a stockpile size compatible with the START II proposals. As the size of the stockpile decreases, however, we are breaking new ground in stockpile surveillance as we attempt to create a prospective forensics program based on fewer systems tests and reduced resources and facilities. We do, however, have good knowledge of the degradation that occurs in technical competence as people age, retire, or leave the program. Ultimately, people are the principal ***limited life components*** of the nation's nuclear stockpile.

Sandia has, therefore, embarked on a formal nuclear weapon knowledge preservation project to assure preservation of competence. A multimedia data-based system consisting of video taped personal interviews, development reports, summary documents on all aspects of technical designs, lessons-learned documents, design guides, film, test data, legacy computer codes and simulation models, and engineering drawings is being archived. We are in the process of computerizing and then linking together all of the applicable data sources. The video taping allows for capturing the why's of design and the art of weaponeering to complement the documented reports. Architectural plans are under Sandia management review to develop a Nuclear Weaponization Design and Training Center that would consolidate the hardware with the multimedia presentation of the data. This requires an investment in the future with the vision to create a facility to allow for teaching, training, and certifying the next generation of nuclear weapon designers. We are working with Los Alamos, Lawrence Livermore, Defense Nuclear Agency, the Air Force Phillips Laboratory, and the University of New Mexico to coordinate and develop cooperative approaches to teaching, in order to avoid duplication of efforts and to ensure that all areas of the nuclear weapon programs are covered. This will preserve the nuclear technology data base and sustain the critical resources and skills. As mentioned earlier, Sandia has accepted the responsibility for the production of neutron generators at the Albuquerque location. The engineering and data files resident at Pinellas, where previous production occurred, number over 1,000,000 documents. As the program is further consolidated, the task of data preservation and transfer is truly demanding of the latest information and archival technologies. Thus, the technology of knowledge preservation is one of the keys to ensuring a safe and enduring stockpile.

The nuclear weapon R&D program supports the technical foundations for all nuclear weapon related design, engineering, testing, production, stockpile surveillance, and weapon dismantlement activities. The program also sustains the core capabilities needed to support all atomic energy defense activities, including those falling outside the direct responsibility of the DOE Assistant Secretary for Defense Programs. These include arms control, nonproliferation, and environmental restoration and waste management at DOE sites. These capabilities are of critical importance to the DOE Office of Nonproliferation and National Security with regard to assessment of possible nuclear weapon development activities in foreign countries.

Sandia, Los Alamos, and Lawrence Livermore face particular challenges today in fulfilling DOE's responsibilities relative to the stockpile.

1) To continue to certify the safety and reliability of the stockpile, not only in the absence of underground nuclear testing but also with decreased reliance on expensive environmental tests, we are forced to place a much larger fraction of our confidence on numerical modeling and analysis. This necessitates a continuing thrust in substantially improving our computational capabilities. To respond to this challenge, DOE has created the multi-laboratory Accelerated Strategic Computing Initiative (ASCI).

2) While we fully recognize that certain components in existing weapons must be replaced at periodic intervals, all weapons now in stockpile will reach the end of their design lifetimes in the next two decades. It is unrealistic, both technically and fiscally, to maintain the vast production infrastructure supported by stockpile management funds that was capable of producing replacement weapons for a stockpile five or ten times the size now projected. To ensure that this future requirement can be affordably met, DOE, through its defense programs laboratories, is also embarking on a major thrust in Advanced Design and Production Technologies (ADAPT).

3) In the past, the stockpile consisted of numerous types of weapons in relatively large numbers which provided a substantial inventory of weapons upon which to gather stockpile surveillance data. Additionally, those weapons were replaced on a relatively regular basis. The future is very different. The number of weapons types are few, the total numbers much smaller, and the expectation is that the stockpile lifetime can be significantly extended. These facts drive us to a substantially different surveillance program for the future.

4) An additional challenge centers on general proliferation concerns and, in particular, on assuring that the former Soviet Union continues its plan of substantially reducing its stockpile without undue safety or proliferation impacts. Ironically, some of our stockpile stewardship capabilities can be shared with the Russians to help them become better stewards of their stockpile, particularly in the areas of security and dismantlement.

Sandia is committed to preserve, sustain, and continuously enhance the core intellectual, technological, and physical infrastructure necessary to support all requirements of the nuclear weapons complex. Our ability to sustain this technical base has been made especially difficult over the past eight years by a sharp decline in weapon R&D funding. Today, for example, the number of scientists and engineers at the Laboratories paid for by the weapons program is the lowest it has been since 1954. We believe that falling below our current level will not sustain a level of R&D adequate to support our required technical foundations and strategic responsibilities.

A critically important element of Sandia's strategy is a strong commitment to R&D partnerships with industry and universities as a way to increase the rate of progress in satisfying DOE's mission needs. Sandia's success in establishing mutually beneficial relationships and dual use technologies with the private sector is, in large measure, a consequence of Sandia's core competencies being well aligned with private-sector interests. These relationships are entirely compatible with the recommendations of the recent report of the Secretary of Energy's Task Force on Alternative Futures for the DOE National Laboratories (the Galvin report), which endorses laboratory-industry collaboration in areas germane to DOE missions. Consistent with Sandia's role in the weapons program, our core competencies derive from a matrix of scientific and integrated technological initiatives that are most generally described by the term, "science-based engineering." Sandia's scientific research is focused on materials, microelectronics and photonics, computational and information sciences, and engineering sciences.

Sandia's principal integrated technological initiatives or "thrusts"—advanced manufacturing technology, electronics technology, advanced information technology, and pulsed power technology—are firmly rooted in our scientific foundations and national security missions and directly address the stockpile issues associated with certification, manufacturing, and surveillance. We commonly refer to these thrusts as "strategic initiatives," because they are technologies of vital importance to DOE's future missions success. Taken collectively, they comprise a tightly integrated body of technical work in which it is difficult to distinguish between "basic research", "applied research", and "technology development".

While the most visible and measurable component of laboratory activity is our ability to deliver components to the stockpile and our success in anticipating needs as measured by stockpile reliability data, perhaps the most challenging product is our ability to preserve and develop the core competencies necessary to sustain the Defense mission."

3.1. Advanced Manufacturing Technology

Manufacturing support technologies are central to our mission for DOE Defense Programs and constitute a large fraction of our technology base. The problems facing the DOE nuclear weapons production complex are formidable. The future operating environment will require manufacturing agility and cost-effectiveness. We will have to design and manufacture to the highest standards of quality. Production will have to occur in an environmentally conscious manner. The nuclear weapon laboratories must continue to design for the total life cycle, including retirement, dismantlement, and disposal or recycling of components and materials. DOE cannot accomplish this mission in isolation from the nation's manufacturing community. Therefore, we regard our collaborative work with industry in areas germane to the DOE production mission as vital to our success.

Sandia's strategic initiative in Advanced Manufacturing Technology derives from its long-standing responsibility for engineering design of DOE non-nuclear components. As a consequence of our responsibilities in systems and design engineering, production process development, intelligent machine research and development, and oversight of the performance and reliability of non-nuclear weapon components over the last forty years, we have become the leader among DOE laboratories for the use and development of advanced manufacturing technologies, technologies which are often of "dual-use" to America's manufacturing base.

This initiative vigorously supports DOE's strategic requirement for Advanced Design and Production Technologies (ADAPT), an important element of the Defense Programs strategic plan. The goals of ADAPT are to enable an affordable design and production capability for DOE in the long term and to continuously support stockpile assurance activities. A key ingredient in this effort is the interactions and partnerships with both commercial industry and the existing DOE production facilities. In the latter case, our relationship is long established and has provided synergistic benefit to the DOE.

ADAPT is a research and development initiative to deliver revolutionary advances in product realization for future management of the nuclear weapons stockpile. The goal of the initiative is to assure an enduring stockpile in an environment of greatly reduced defense expenditures and constant change. ADAPT will exploit advances in information, computation, and communications technologies to integrate advanced design, modeling, materials, and process tools and methods to create a product realization environment that will enable the continued delivery of safe and reliable products to DOE defense customers. To be successful, ADAPT cannot merely develop a new suite of manufacturing technologies; it must provide a new way of conducting the business of designing, developing, and delivering DOE products to customers. The success of the initiative will be measured by the ability of the nuclear weapons complex to quickly deliver ultra-high-reliability products in low volume at minimum system cost.

Most of the weapons in the enduring stockpile were designed and qualified for stockpile lives of twenty to twenty-five years, and while they can be expected to remain safe and reliable for an unknown period in excess of their design life, limited data exists to predict what the actual service life will be. Past stockpile experience indicates that the reliability of warheads in stockpile will degrade with time unless action is taken to repair, requalify, or renew them. Independent of the effects of aging, a significant unexpected defect affecting one of the weapon systems in the stockpile is typically discovered about once every year. Finally, the warheads that constitute the enduring stockpile were all developed and produced within a rather limited time span, so they all contain similar parts and components and were produced with similar processes. This heightens a concern that significant portions of the aging stockpile may be subject to common failure modes.

It is clear that to ensure that the stockpile remains safe, secure, and reliable, the nuclear weapons complex must establish and retain the capabilities needed to repair, requalify, or renew warheads in the stockpile. Furthermore, it is important that the complex maintain the capability to design and develop new weapon components and subsystems since military requirements may change. Moreover, it will be impossible to precisely duplicate the weapons currently in the stockpile, since the original technologies may be obsolete, the original materials and processes may no longer be available, and original facilities may no longer be usable.

To meet the challenge of delivering first-time, high-quality hardware and to minimize costs, we must apply advanced information and communication technologies to create a virtual factory environment including both commercial and DOE Lab and plant sources using commercial components and processes to the greatest extent reasonable.

Computational tools must be developed to enable individual scientists and engineers to deal effectively with a wider spectrum of problems than is typical today. Computational tools will allow the rapid optimization of component designs for performance, cost, and manufacturability. Other tools will facilitate the selection, specification, and integration of commercial components and low-impact processes and technologies.

For a variety of security, business, or technical reasons, it is impractical to rely on industry for all the components required for nuclear weapons. Consequently, DOE must retain a core in-house manufacturing capability, including some manufacturing facilities. To most effectively use these capabilities, new or improved materials and processes must be developed to enhance efficiency, minimize wastes, environmental impacts, and cost, and provide greater worker safety. Where possible, such facilities should be rapidly reconfigurable to support the manufacture of a spectrum of parts or components.

The ADAPT initiative will be composed of a variety of specific activities conducted within six cross-cutting technical programmatic elements. The "knowledge engineering" element will retain and facilitate access to weapon design, engineering, materials, processes, and fabrication expertise. The "virtual manufacturing" element will implement integrated tools for manufacturing operations. The "modeling and simulation" element will develop tools for model-based design, process simulation, and performance prediction. The "advanced materials and processes" element will develop materials, manufacturing, and qualification processes for an affordable, reliable stockpile. The "information and communications element" will develop the hardware and software infrastructure for distributed design, process engineering, and manufacturing. It will also establish electronic and administrative business methodologies that will enhance agility and reduce cost.

Our Center for Advanced Manufacturing Technology at Sandia's New Mexico location provides a forum for collaborative work with industry on the manufacturing needs of both the DOE nuclear weapons complex and commercial manufacturers. Sandia's California location is strategically important to our advanced manufacturing initiative as a point of contact with the high-technology industries of the West Coast. The Integrated Manufacturing Technologies Laboratory in Livermore conducts collaborative research and development in materials and processes, process simulation, engineering design, and manufacturing technology support. It also performs research in prototype fabrication and demonstration techniques for agile manufacturing, both for DOE and the domestic industrial sector. Current work focuses on metal removal and welding, weld process simulation, composites fabrication, high-speed communication of manufacturing data, and on-line monitoring and control.

The investment in the ADAPT initiative will result in a nuclear weapons complex that will be able to safely, efficiently, and cost-effectively repair, requalify, or renew weapons and components in the enduring stockpile as they age. This capability will, in turn, provide an affordable, safe, and reliable nuclear deterrent.

3.2. Electronics Technology

Electronics technology is critical to the DOE and DOD mission, and it is especially important for Sandia's responsibilities in component design and in addressing the stockpile surveillance needs of the future stockpile. Special-purpose electronic components in nuclear weapons include coded switches that prevent unauthorized use, tamper detectors, programmers that control the arming and firing sequence of the weapon, radars, and fuzing and firing sets. These devices must operate reliably over a large temperature range, survive strong mechanical shock, and be fully functional following exposure to intense pulses of ionizing and electromagnetic radiation.

Electronics is also critical in nonweapon applications of DOE national security programs. Satellites that monitor compliance with international arms control agreements require microelectronic devices hardened against the ionizing radiation of space. Application-specific microprocessors and embedded computers are needed by many of the systems used to verify treaty compliance and assess activity in foreign countries that may indicate work on weapons of mass destruction. Also, advanced sensors such as chemical microsensors, light detecting and ranging (lidar) systems, and high-performance synthetic aperture radars developed in this program element offer new capabilities for arms control and proliferation assessments.

DOE's requirements for many electronic devices cannot be met with commercial electronic products. Sandia is unique among the national laboratories in having design and production oversight responsibility for all electronic components in DOE nuclear weapon systems. Sandia's successful fulfillment of this mission has created a world-class capability to design, model, test, and prototype electronic subsystems. To meet its mission requirements, Sandia has developed a broad-based competency in electronics, from the fundamental science of semiconducting materials to device design and manufacturing processes. We can only maintain this capability in partnership with industry, and our program collaborates intensely with the semiconductor industry and universities through consortia and other arrangements.

One way in which we interact with industry is through team pursuit of industry-generated technology road maps such as those prepared by the Semiconductor Industry Association and the Optoelectronics Industry Development Association. In addition, we provide a direct mechanism for applying university research to manufacturable electronics products and processes.

Sandia's Center for Microelectronics Technologies provides a unique capability for research and development relevant to both DOE and industry. This capability is being accessed by industry through a five-year, $100 million cooperative research and development agreement (CRADA) with the SEMATECH consortium, as well as through CRADAs with individual companies. The Center is supported by a large range of semiconductor and microelectronics capabilities. Activities of the Center in support of the U.S. semiconductor industry include the Semiconductor Equipment Technology Center (SETEC), the Contamination-Free Manufacturing Research Center, and the Equipment Design Support Center—all joint projects with SEMATECH.

Sandia's Electronic Quality/Reliability Center (EQRC) performs cooperative research and development to understand why devices fail and to develop new reliability and failure analysis techniques. EQRC has an extensive interdisciplinary capability in characterization, benchmarking, assessment, modeling, and simulation. Sandia's reliability engineering program focuses on ultra-reliability in electronic components for nuclear weapons, and these techniques are synergistic with the capabilities and needs of commercial electronics manufacturers.

Cooperative R&D agreements (CRADAs) with interested industrial participants yield significant benefits to the nuclear weapons program and help reduce the cost of this research to DOE. The Electronic Quality/Reliability Center has entered into ten CRADAs with manufacturers of integrated circuits or related equipment or software. CRADA partners include Intel, National Semiconductor, LSI Logic, Advanced Micro Devices, Philips, Analog Devices, Schlumberger, Hewlett Packard, Honeywell, and Micron. These partnerships are rooted in the reliability needs of Defense Programs and have produced significant benefits to DOE.

Photonics is an emerging technology that uses visible-light energy for functions normally performed by electrical energy. Because of their inherent immunity to electromagnetic interference and their tolerance to the effects of ionizing radiation and intense pulses of electromagnetic radiation, photonic devices offer unique advantages over electronic devices for a wide variety of surety and reliability applications in nuclear weapons.

Sensor research and development in this program element include radars used to command the firing of a weapon and provide precision terminal guidance, components that detect unauthorized tampering, use-control devices, accelerometers, and chemical sensors to assess the condition of weapons in stockpile.

Other applications of Sandia's electronics technology initiative directly impact the nuclear weapons stockpile, weapons surety, advanced weapons designs, and process sensing/control for the nuclear weapons complex. One envisioned application is advanced, chemically selective sensor arrays integrated with radiation sensors to detect very low levels of corrosion by-products to monitor the integrity of the stockpile and indicate potential problems. Chemical sensors are now used to monitor weapon production processes by providing real-time control of possible chemical emissions into effluent streams at DOE manufacturing facilities. This is an application for which laboratory-sized analytical instruments are not cost-effective or suitable due to power, space, and time limitations.

DOE's strategic investment in Sandia's electronics competency is crucial to stockpile stewardship now and in the future. As the stockpile ages, replacement weapons must incorporate contemporary electronics technology, modified to meet the stringent requirements for nuclear weapons. Many of the nuclear weapon systems in the stockpile are decades old and contain antiquated technologies such as discrete-component electronics and even vacuum tubes. It is not possible to maintain subsystems based on obsolete technologies for which the contemporary industrial base no longer exists. An important responsibility of the nuclear weapon R&D program—and a major responsibility for Sandia—is the modernization of non-nuclear component subsystems of weapons in stockpile. This capability can only be kept modern through intensive collaboration with industry and university researchers.

3.3. Advanced Information Technology

Under the nuclear weapons R&D program, Sandia continues to develop and maintain the advanced computational capabilities that are essential to our nuclear weapon responsibilities, and in particular, to the certification of the safety and reliability of the stockpile. In the broadest terms, computation and modeling, through the simulation and modeling of complex systems, reduces overall program costs by assisting with risk reduction early in the system life cycle and reducing the need for physical testing.

DOE's stockpile stewardship and management program will rely on computational simulation to compensate, to the extent possible, for the loss of experimental capability resulting from the U.S. commitment to end underground nuclear testing. In addition, the ability to design non-nuclear components of nuclear weapons, analyze their performance, predict their surety and reliability as they age, and certify their functionality as an integrated system is essential for conscientious management of the enduring stockpile. This activity, which is a central responsibility of Sandia, ordinarily requires expensive environmental testing. Computational simulation will help avoid much of the cost of this kind of testing.

The Accelerated Strategic Computing Initiative (ASCI) is a DOE Defense Programs initiative designed to support the stewardship of the enduring nuclear stockpile without the benefit of nuclear testing and with limited non-nuclear tests. The summary goal of ASCI is to promptly shift from test-based to computational-based methods as the basis for stockpile stewardship.

Computational simulation must be developed further if it is to be suitable as a surrogate means for verifying the safety, reliability, and performance of the nuclear stockpile. Virtual testing and prototyping rely primarily on the use of validated, numerical simulation tools for certifying weapon performance, safety, and reliability, as well as for weapon design and manufacture. Rudimentary versions of virtual testing and prototyping exist today. However, to meet the needs of stockpile stewardship in the year 2010, virtual applications must achieve high-resolution, full-physics, and full-system capabilities.

Such a level of simulation requires high-performance computing far beyond the current level of performance. Current simulation applications are limited by today's computing capabilities, rely heavily on testing, and are not adequate for a detailed, independent analysis of new designs or unanticipated changes in existing designs. In addition, these applications were not designed to operate efficiently on the Massively Parallel Processor (MPP) architectures that will be required for virtual testing and prototyping. These applications must be rewritten to incorporate refined physics algorithms, three-dimensional capabilities, and MPP efficiency.

In the area of high-end computing for ASCI, Sandia will have lead responsibility for a research partnership with the computing industry that will focus on the development of a new massively parallel computer composed of thousands of processors, providing teraflop performance and terabyte memory capacity. This effort will capitalize on Sandia's expertise and leadership in computer science and high-performance computing to deliver a new computing capability that will support the development of defense programs application codes.

Sandia's strategic initiative in advanced information technology is aimed at developing massively parallel computing technology and a software infrastructure for parallel computing. One of our distinguishing strengths in this area is the ability to develop and integrate theoretical models, advanced numerical methods, and computing technology to create robust, state-of-the-art tools for simulating complex systems and processes.

The Massively Parallel Computing Research Laboratory at Sandia is a national resource for research in high-performance computing and its application to practical problems in science and engineering. An interdisciplinary team of more than sixty research staff carries out projects in computational and computer science and in discrete and numerical mathematics.

The Massively Parallel Computing Research Laboratory has led the development of algorithms since its award-winning introduction of massively parallel techniques for real engineering applications in 1987. Since then, several awards have been received recognizing Sandia's ongoing contributions to massively parallel computation. Most recently, a Sandia/Intel team regained the world computational speed record from the Japanese by a large margin, after having lost it to the Japanese a few months earlier.

In their work to advance the state of computational simulation, researchers at the laboratory have invented massively parallel linear algebra methods, new algorithms for molecular mechanics and dynamics, highly scalable methods for quantum chemistry, automatic finite-element adaptive mesh-generation techniques, powerful domain-decomposition and load-balancing techniques, and data visualization methods. Advances in systems technology include portable, lightweight parallel and distributed operating systems, virtual reality environments, new multi-threaded architectures, object-oriented C++ constructs for massively parallel applications, and new routing algorithms. Numerical research at the Massively Parallel Computing Research Laboratory is complemented by research in discrete mathematics that includes algorithms for difficult combinatorial optimization problems. This work also involves new communications algorithms for parallel and distributed computing.

For the Advanced Applications Development thrust of the ASCI initiative, Sandia has proposed four projects which will provide advanced simulation capabilities for three important classes of problems. In the area of virtual testing and safety, we have proposed the development of a capability for simulating accident environments, predicting full weapon-system response, and assessing nuclear detonation safety for complex combined-environment accident scenarios

In the area of material aging, we have proposed a project to develop a capability for predicting grain-scale microcracks in solder joints, which occurs as a result of thermal fluctuations during weapon storage and transportation and which has led to electrical component failures. A second proposed material aging project is to develop a capability for predicting the dominant factors in oxidation and deterioration of the Kevlar polymeric material used in parachute strapping for laydown bombs. There are no data on Kevlar aging, due to its relatively recent development, and the proposed simulation methods will be useful for predicting the lifetime of a parachute and for identifying the environmental factors that can be controlled to prolong its service life.

In the area of virtual prototyping, we have proposed a project that will develop computational methods for specifying the forging and welding process variables for remanufacture of limited-life components in gas transfer systems. If successful, this project has the potential to save DOE money by permitting standard industry practices that can provide the required performance of certain manufactured parts for nuclear weapons.

Finally, Sandia will also play an important role in the development of the infrastructure required to support the use and availability of the high-end computing platforms to be developed by ASCI. This infrastructure includes operating systems, high-speed networks, and high-speed storage. This effort will capitalize on Sandia's expertise and leadership in high-performance computing and networking.

3.4. Pulsed Power Technology

Pulsed power accelerators provide uniquely large, energetic, and powerful laboratory environments for the nuclear weapon program. Pulsed power accelerators were originally developed to simulate the output of nuclear weapon explosions on electronics, but have been broadly applied to inertial confinement fusion (ICF), beam/matter interaction, and to generation of large x-ray yields. The three most powerful accelerators in existence are applied to defense programs at Sandia. Saturn produces 20 TW (terawatts) of 1 MeV (million-electron-volt) x-rays, and Hermes III produces 15 TW of 20 MeV x-rays for radiation effects science and simulation. PBFA II produces 10 TW of 9 MeV lithium ion beams for ion-driven ICF target experiments.

The high-energy-density plasma environments created by these accelerators are used to simulate the effects of nuclear weapon explosions on weapon components, study nuclear weapon physics in the laboratory, and study the physics of inertial confinement fusion targets. These capabilities are distinct from, and complementary to, laboratory environments produced using laser techniques. For example, the temperatures produced today by these accelerators are typically one-quarter to one-third those produced by lasers, but the volumes heated today are 50 times larger than those heated by lasers at comparable temperature; the energies in x-rays are 20 times larger, and the duration of the x-ray pulse is 10 times longer. Thus, for certain technical issues and many related weapon issues, pulsed power accelerators provide a very substantial benefit.

I am pleased to say that because of advances made in just the past few years, the promise of this technology to deliver energetic sources of x-rays efficiently and at low cost for the nuclear weapon program has been achieved. For example, the x-ray environment available today on the Saturn accelerator at Sandia consists of 600,000 joules of x-ray energy in a volume of 5,000 cubic millimeters for a time scale of 20 nanoseconds produced with an overall efficiency from wall plug to x-rays that now exceeds 15 percent. Saturn is the most energetic source available in a short pulse for studies of x-ray physics.

The progress does not stop here. The integration of multidimensional computational codes, precise space-time and spectrally-resolving diagnostics, and powerful laboratory experiments has furnished an important scientific basis for extrapolating laboratory environments to even greater energy and utility for the nuclear weapon program. One of our near-term objectives is to advance the x-ray environment demonstrated on Saturn to greater energy in our PBFA II accelerator. With data from PBFA II, we expect to have confidence in the extrapolation of the x-ray source for the weapons program to a level exceeding 10 million joules of x-rays.

This advance would occur in a step beyond our present facilities in the proposed Jupiter accelerator. Jupiter is intended to permit laboratory research into the high-energy-density physics that underpins DOE's weapon physics program. It will also replicate a wide range of x-ray environments previously provided by underground nuclear experiments. Such capabilities will make it possible to continue testing components and systems without underground testing. We also look forward to the continued close involvement in applying pulsed power accelerator environments to all aspects of the nuclear weapon program through multidisciplinary, multi-laboratory teams that already exist with Los Alamos and Livermore national laboratories.

4. Nonproliferation and Counterproliferation

Sandia supports DOE with research, development, and analysis for intelligence, proliferation detection, arms control, and verification technology. Sandia has one of the oldest and largest programs of such work in support of U.S. national security policy. This work continues to complement our nuclear weapon research and development responsibility, which provides requisite expertise for knowledgeable nonproliferation and arms control R&D activities.

Under the sponsorship of the Department of Energy's Office of Nonproliferation and National Security, Sandia has created a program and facility known as the Cooperative Monitoring Center (CMC). At the Center, national security specialists from around the world can evaluate potential roles that technology might play in helping to solve the pressing regional security problems which have largely overtaken bilateral Cold War issues as the dominant national and international security problem of the 1990s. The Center has been configured to allow regional participants to see and experiment with a wide variety of technological approaches to arms control, confidence building, environmental, and other national security problems. Examples include satellite monitoring systems, unattended ground sensors, on-site inspection support systems, etc. Because the technologies involved are outgrowths of DOE's multi-decade nuclear weapon and arms control programs, the CMC truly represents a "swords to plowshares" program. This facility, located in Albuquerque, is a unique national resource which has already successfully hosted participants from the former Soviet Union, the Middle East, South Asia, and the Pacific Rim.

The Verification and Control Technologies program includes R&D on a variety of systems, technologies, and processes applicable to the detection of proliferation of weapons of mass destruction and verification of agreements for transparency and arms limitations. An increasingly important aspect of all these program areas is Sandia's activity in information management, fusion, and analysis.

Sandia is developing new nuclear detonation sensors for improved detection of explosions in the atmosphere. Instrumentation systems currently being deployed on the Global Positioning System constellation of satellites will soon provide continuous worldwide coverage.

We have initiated development of satellite-based systems and technology for detecting and characterizing nuclear proliferation activities. Such systems could have potential application to the detection of chemical weapons, biological weapons, and missile development as well.

Sandia has projects to develop chemical sensors related to nuclear and chemical weapons, ultraviolet light detection and lidar ranging technology, radiation detection sensors, remote video surveillance systems, and the nondestructive determination of particulate compositions. In some instances, component technology will be incorporated into unattended, and possibly remote, ground-based sensor systems.

We develop synthetic aperture radar systems for a wide variety of treaty verification and nonproliferation applications. We are also exploring the integration of synthetic aperture radar with other imaging data and automated data analysis as methods for dealing with the large volume of data from such systems. Synthetic aperture radar will be used to evaluate all-weather as well as day-and-night aerial inspection capabilities.

Tags and seals are currently being considered for use in securing key elements associated with the Chemical Weapon Convention, weapon dismantlement, and the containers designated to transport and store U.S. and Russian special nuclear material. Sandia has also broadened the tag and seal effort to include the technological area of information integrity, which covers the general application of tags and seals over a wide range of monitoring applications. New data-authentication techniques are being developed to provide security for remotely monitored, sensor-based sealing systems.

Development of seismic technology for detection, location, and identification of underground and underwater nuclear explosions is continuing. In line with the emerging geopolitical climate, the emphasis of this program has shifted from the monitoring of bilateral test limitation agreements to global monitoring of a comprehensive test ban, as well as monitoring of proliferation-related nuclear testing. Our R&D activities are a part of a multi-laboratory effort and are focused on verification-quality seismic and hydro-acoustic data acquisition and processing that is affordable, easily deployable, and flexible. Our technology development activities are being coordinated, and in many cases co-funded, by DoD, which has the operational nuclear test monitoring responsibility within the U.S. government.

During the cold war, Sandia and the other DOE Defense Programs laboratories worked as a team with DoD to design, develop, manufacture, and maintain a credible, safe, secure, and robust nuclear deterrent. In carrying out that mission, the laboratories invested in extensive capabilities for research, development, product realization, and testing of nuclear weapons. These capabilities include state-of-the-art theoretical and simulation methods using the world's fastest computers, advanced materials laboratories and process control technologies, systems engineering and technology integration skills, and an extensive set of field test capabilities. In addition, the laboratories developed sensors and information systems to support the requirements for monitoring and verifying international arms control agreements. These systems include both space-based and ground-based global nuclear detonation detection sensors and the information networks and data processing capabilities to integrate them.

These skills, capabilities, and facilities can be readily applied to the counterproliferation challenge, and the successful teamwork relationship we have had with DoD for the last half-century can still be a formula for success. Some DOE weapons programs facilities, such as the underground nuclear testing facilities in Nevada, will have to be maintained in a state of readiness even though testing of nuclear weapons is unlikely to resume in the foreseeable future. These facilities can provide a cost-effective test bed for counterproliferation technology development in conjunction with DoD. It would be a prudent use of the government investment in these facilities to employ the DOE nuclear weapon laboratories to help resolve critical technical issues related to counterproliferation. This activity should be in partnership with the armed services, the DoD laboratories, and industry groups who will provide the actual counterproliferation hardware.

4.1. Former Soviet Union (FSU) Activities

The breakup of the Soviet Union created a changed world, as exemplified in President Bush's speech of September, 1991, where he pledged U.S. technical cooperation in nuclear weapon safety and security. Congress supported this initiative with legislation that provided funds for the DOE laboratories to develop collaborative arrangements with weapon laboratories of the former Soviet Union to encourage stabilization of those institutions in peaceful technical work. The urgent nonproliferation concerns brought about by the breakup and the U.S. desire to support a fragile, emerging, free-market economy led to requests for Sandia and other DOE laboratories to use our technical expertise to address these problems. Sandia's goals for cooperation with the former Soviet Union are to support U.S. Government policy on nonproliferation, access high-quality FSU science and technology, support FSU stability and commercialization, build long-term professional relationships with FSU weapons scientists, and assist U.S. commercial interests to access FSU technology and to identify viable ventures. Sandia supports a range of cooperative measures, from interactions under government-to-government agreements to direct lab-to-lab contracts.

Safe and Secure Dismantlement Programs are funded by DoD under a government-to-government agreement and administered by the Defense Nuclear Agency (DNA). A $21.5 million project was completed recently with delivery to Russia of 125 rail car kits to upgrade the safety and security of cars used to transport nuclear weapons. Flexible armor blankets to protect weapons from small-arms fire were delivered in 1994. We have evidence that they are in use to protect weapons being withdrawn from sites. Fissile material containers were designed and tested by Sandia to transport and store material from dismantled weapons. DNA has a production contract to provide 33,000 of these containers. Requirements for the 3.5 million-dollar design effort were based on International Atomic Energy Agency crush-and-burn standards for plutonium transport. Additionally, Sandia provided portable integrated video systems to support two-way, four-channel video communications between a command post and site of a nuclear or other emergency.

Recently, Sandia has provided analysis of physical protection and other issues for a proposed fissile materials storage facility in Russia, but a recent complete design change initiated in Russia has put this effort on indefinite hold. Present involvement is limited to attempts to assure compatibility of the Sandia designed containers with the new storage concept.

The Exchange in the Fields of Nuclear Weapon Safety and Security is a government-to-government agreement signed December 16, 1994, by Vice President Gore and Prime Minister Chernomyrdin. This program is expected to be a technical exchange, with the national laboratories providing technical leadership. Working groups will be formed in three technical areas: (1) enhanced safety and security of both nuclear warheads and material during dismantlement; (2) enhanced safety, security, and physical protection of nuclear warheads and their components through external means; and (3) technical assessment of open-source materials regarding nuclear warhead design and recommendations for criteria. The first meeting of the coordinating group for this agreement occurred in February, 1995. A wide range of important safety and security topics were recommended for further collaborative work.

The Industrial Partnership Program is intended to provide a mechanism for Russian scientists to build careers in the civilian workplace. It makes use of the capabilities resident in DOE's national laboratories and makes new technologies available for commercialization by U.S. industry. Sandia presently has 59 projects with 35 participating institutions in the former Soviet Union for a total of $4,625,000 in contracts. In addition, three cooperative R&D agreements (CRADAs) with $1.2 million of DOE funds have been approved.

Material Protection Control and Accountability (MPC&A) projects are coordinated by a multi-laboratory steering committee. About $15 million is available in fiscal 1995 for upgrading material protection control and accountability in a program initiated by DOE Undersecretary Curtis. A joint plan is now being coordinated by the steering committee with its counterpart committee of MINATOM laboratories led by Arzamas-16 (VNIIEF). Sandia will supply physical protection technology and system design expertise for these efforts. Sandia has nearly completed contracts with the Kurchatov Institute for about $700,000 to provide physical protection for one nuclear facility at Kurchatov. This work was completed in a few months and is considered both a success and a learning experience for future security upgrade efforts in Russia. Follow-on activities to bring more of the nuclear material at Kurchatov under control are in the discussion stage. All our MPC&A work is intended to develop the necessary culture, design concepts, and infrastructure to allow the facilities, with some U.S. funding support, to take responsibility for and implement their own effective MPC&A systems.

The Surety Technology Exchange was initiated as a "jump-start" tri-laboratory program with Arzamas-16 (VNIIEF) and Chelyabinsk-70 (VNIITF) to collaborate on non-weapon surety topics.

To date, four symposia have been completed:

- risk assessment and system response (at VNIITF)
- transportation safety and accident-resistant containers (at Sandia)
- hazardous waste management (at VNIIEF), and
- energetic materials (at Lawrence Livermore).

Many mutually beneficial topics for collaboration were identified, leading to about 40 contracts worth about $1.5 million at Sandia. These programs are funded by DOE Defense Programs and involve about one hundred Sandians and four hundred Russians. Individual relationships of trust have developed along with close scientific ties and worthwhile work.

Energy and Environment Projects include the TOPAZ space reactor project, supported by the New Mexico Alliance (Sandia, Los Alamos, and the University of New Mexico) and five international participants. Significant technical spin-offs are expected from the TOPAZ thermionic technology, including high-temperature metals and insulators. An example of an environmental project is the EnviroTRADE interactive system containing information on international environmental problems and environmental technologies. EnviroTRADE workstations have been installed at four Russian institutes.

Lab-to-lab projects are science-driven, small R&D collaborations that are closely coupled to Sandia projects. A broad range of science and technology is involved, including nuclear power safety, environmental technologies, safety and risk assessment, innovative materials development, lasers, pulsed power, medical technologies, nonproliferation research, manufacturing technologies, energy, computation, and basic science topics.

5. Maintaining Technical Leadership into the Next Century

It is a widely held view that the DOE National Laboratories are national assets. Yet, these Laboratories are the topic of considerable study and debate concerning their role in the post–cold war era and what changes in management or governance might be appropriate. Two recent reports that address these issues have undoubtedly come to your attention: *Alternative Futures for the Department of Energy National Laboratories* (the Galvin report) and *National Laboratories Need Clearer Missions and Better Management* (a GAO report).

A common theme in these studies is the importance of mission focus in the DOE laboratories. The technical challenges inherent in DOE's existing missions are formidable. However, an extremely diverse array of core technical competencies and other capabilities covering the full spectrum of the science and engineering disciplines must be maintained at world-class levels if the Laboratories are to perform their DOE missions consistently.

DOE's strategic plan for Defense Programs is designed to preserve the broad technology base required for national security missions. I support this strategic plan. I must emphasize, however, that the plan requires a multi-year commitment of funds, including substantial increases in the near term, to achieve its goals. It anticipates a substantial investment for the next several years to achieve a laboratory and manufacturing complex that will perform the Defense Programs missions at significantly less cost than the current enterprise.

The nuclear weapon R&D program is the historical source of support for the technical foundations of the Defense Programs laboratories. It has become clear, however, that these funds will not be sufficient to sustain technical foundations and strategic initiatives at the level that will be required for DOE missions. Therefore, it is essential to supplement this support with funds-in from other DOE programs and appropriate work for other federal agencies (primarily the Department of Defense).

Both the Galvin and GAO studies emphasize the importance of a more disciplined mission focus in the DOE laboratories. I do not disagree with their observation. But we must take care that greater mission differentiation among the DOE laboratories does not lead away from the multiprogram concept and toward single-mission laboratories. The multiprogram, multidisciplinary environment is absolutely essential for excellence in most of DOE's missions. The synergy that exists in a multiprogram environment enhances mission performance.

The multiprogram environment is also essential for attracting top technical talent to the laboratories. Young scientists and engineers want to look forward to interesting careers that offer the opportunity for a variety of challenges. They do not want to be constrained within a very narrow mission focus for thirty or forty years. This is especially true for the DOE national security mission. It will be very difficult to recruit top talent into the nuclear weapon program if multiprogram opportunities are not available. Bear in mind that a major rebuild of the weapons in stockpile will be required in about fifteen to twenty years, and most of our current nuclear weapon engineers will have retired by then. Consequently, recruitment is of vital concern.

5.1. Health and Status of the Laboratory

Sandia today is a strong institution that continues to make outstanding contributions to our nation's security, prosperity, and well-being. Management at Sandia understands that conditions have changed and that adjustments in how we conduct business are required. In fact, we have been making substantial changes during the last five years to anticipate and accommodate these evolving conditions.

However, some trends are more worrisome than others because we have little management control over them and they may have strategic implications for the health and capability of the laboratory. Foremost among these trends is the continuing decline in nuclear weapon R&D program funding that I alluded to previously. This program is the foundation of our capability in all of the nuclear weapon-related competencies that are required to fulfill our mission. While it is true that no new nuclear weapons are being developed, it does not follow that the foundational funding for that capability should diminish proportionately. Moreover, I believe that I have illustrated that diverse technical activities are required for the ongoing stewardship of the nuclear weapon stockpile and its supporting infrastructure.

Engineering and production processes must be allowed to evolve and to be restructured to meet future stockpile needs. In the past, we maintained the assets needed for nuclear deterrence by continuously working on new system designs, meeting ever more challenging system requirements, supporting a steady production schedule, conducting full system tests, and predictably retiring and replacing old systems. This approach, based on the steady flow of a high-capacity nuclear weapon program, maintained and enhanced the infrastructure and human assets that ensured deterrence.

We now need to find another way to maintain and enhance these critical human assets. In the future, deterring another arms race will increasingly be a function of the perceived capability of our nation to respond rapidly and convincingly to new challenges involving nuclear weapons. If that capability is vitiated, we may be vulnerable to a new nuclear challenge in the future, as our stockpile ages and our design talent retires.

Sandia's employment level has not changed dramatically in the last decade. We ended FY 1994 with nearly 8,500 personnel, up from nearly 8,200 in FY 1984. Yet, in the same time period, the number of technical personnel directly supported by nuclear weapon R&D program funds declined by one-third (from 1,500 to 1,000). This is the core program that feeds experienced talent to all other national security programs at the laboratory.

The morale of our staff is fair. People understand that other sectors of the defense community have been hit much harder than we have. However, anxiety exists regarding the future of the weapons program, the health and well-being of the laboratory, and the long-term employment picture.

5.2. The Need for Industry-Laboratory Collaboration

The technology bases for government and commercial needs are rapidly converging. I am firmly convinced that collaboration with industry and universities is essential for the DOE laboratories' mission success. While mutually beneficial collaboration with individual companies will continue to play a significant role, increasing emphasis should be placed on generic, precompetitive research and development that can be broadly useful for an entire industry. Technical assistance by DOE laboratories to small- and medium-sized companies is also a responsible way to increase the return on the federal investment in DOE's technical assets to the taxpaying public at minimal incremental cost.

Benefit to the weapons program from collaborative activities can be classified in at least three ways:

1. Weapons program activities addressing current stockpile needs coincide with private sector interests.

In these cases, the weapons program can benefit substantially from working cooperatively with industry as a result of the leverage provided by the partner's in-kind contributions to the project, the cost-free access to specific partner capabilities, the expanded reliability that results from partner-testing of components or materials, and the development and maintenance of commercial suppliers for defense programs product needs.

One technology area that fits in this category is Environmentally Conscious Manufacturing (ECM). Our cooperative R&D projects in ECM involve co-development of processing technologies that minimize the generation of wastes at the source, systems integration of environmental design factors (including life-cycle design, materials recycling, and value-impact assessments), instrumentation for environmental monitoring in production facilities, and development of nonintrusive process diagnostics and controls.

One specific example of benefit to DOE is our program to co-develop, through collaboration with the private sector, lead-free materials and procedures for use in the assembly of nuclear weapon components. Health risks and environmental damage associated with lead-derived solders and fabrication processes that utilize lead have prompted efforts to curtail the use of such materials in the weapons complex and in private industry. Joint evaluation by Sandia and AT&T was made of commercial lead-free solders as well as a new alloy developed by Sandia. The project currently focuses on applications of lead-free solders in nuclear weapon components, including surface-mount operations on a clock board and hand-soldering processes on a firing-set board.

There is a strong push in industry to develop the capability for cost-effective, small-lot manufacturing of tailored products. The term for this is agile manufacturing, and it corresponds exactly with DOE's vision of a smaller nuclear weapon production complex that can perform small-lot, high-technology fabrication cost-effectively. DOE cannot achieve this vision by itself; it must learn from industry—and develop with industry—the advances in manufacturing engineering that will be required to realize this vision.

2. Cooperative work with industry supporting technology base capabilities or core competencies that address weapons programs needs on the 3–10 year horizon.

A specific example of this type of benefit to the weapons program involves co-development of practical optoelectronic technologies with industry. Optoelectronic components offer strong advantages over electronic components in terms of immunity from electrical noise and static discharges (including, for example, a lightning strike), freedom from interference, and directionality. This technology can directly impact a variety of weapons program needs in the 3–10 year time frame, including:

- Optical firesets and optical transmission of energy
- Ring-laser gyroscopes
- Detectors and modulators for wide-area networks for secure communications within the nuclear weapons complex
- Non-invasive interrogation for weapons surety and state-of-health monitoring

Sandia is a leader in the pursuit of photonic integrated circuits. Our basic materials competency in strained layer semiconductors led to several pioneering applications in optical detection and light-wave modulation. A CRADA between Sandia and Hewlett Packard on advanced manufacturing techniques for optoelectronics is further developing this strained-layer technology with one of the United States' few optoelectronics manufacturers. National security programs will benefit from having a domestic source for this critical defense technology.

3. Cooperative work with industry on carefully selected civilian or defense projects exercising key nuclear weapon competencies that must be maintained but are critically underutilized because of the lack of new weapon development.

Cooperative projects of this sort help ensure that the weapons engineering skills and design judgment of our staff remain up-to-par to meet future needs. Weapon engineering skills cannot be maintained through simulated design exercises alone. Engineers must work with real designs for real products to keep their skills sharp. Collaborative design of components for civilian or defense systems can provide useful experience. Moreover, the laboratories must offer challenging, dual-benefit, scientific and engineering assignments if it hopes to recruit the best technical talent to support national security programs.

Sandia has for many years worked as a partner with industry on DoD programs that can benefit from unique nuclear weapon-related technologies. Such non-nuclear defense work exercises the applied engineering skills that underlie nuclear weapon competency.

More recently, commercial-sector projects are helping maintain these unique skills. For example, about three years ago, we became concerned that our world-class parachute technology group was approaching a critically low level to meet potential weapons program needs. High-performance parachutes are critical components of several DOE and DoD weapon systems. They directly affect the performance, mission effectiveness, and reliability of the weapon and are vital to the survivability of the delivering aircraft. We have been fortunate, recently, to partner with an industrial entity that can apply these essential parachute design skills to a commercial product. This collaboration has helped the weapons program maintain a critical skill. It has also helped U.S. industry achieve a leadership position in a technology with a substantial commercial potential. In my view, this is an example of the kind of collaborative work with industry that is necessary and appropriate for the DOE National Laboratories. This CRADA and others like it were partially funded by the DOE Defense Programs Technology Transfer Initiative (TTI). The TTI serves a very important function by making such mutually beneficial collaborations possible. Loss or major redirection of this source of funding would seriously damage our ability to carry out our weapon-program responsibilities.

5.3. Laboratory Governance

The Galvin Task Force makes a bold recommendation to convert the governance of the DOE laboratories to a new basis. The Task Force believes that the GOCO (Government-Owned, Contractor-Operated) concept, the model on which the laboratories have operated for the last fifty years, has been irretrievably weakened through unrestrained growth in government micro-management, rule-making, and oversight, and they discount the department's ability to revitalize it. In their view, only through de-federalization will the laboratories be able to operate with the efficiency and flexibility found in the private sector.

The Galvin Report would create a not-for-profit R&D corporation to manage the laboratories under a board of trustees appointed by the President. Congress would provide multi-year block-funding and the corporation would allocate these funds to the laboratories, with DOE functioning as the government sponsor of the corporation and the laboratories.

The rationale for such a radical change in governance is based on the belief that, unless something is done to buffer the laboratories from the DOE bureaucracy, the inevitable tendency of bureaucrats to "micromanage" will continue to dominate. Moreover, having a board consisting *"primarily of distinguished scientists and engineers and experienced senior executives from U.S. industry"* would tend to insulate the laboratories from partisan politics and provide a measure of stability.

Such a "clean sheet of paper" approach is well-intentioned and, in principle, could offer many advantages. Nonetheless, as proposed, it does not seem to me either practical in the near term nor sustainable over the long term. The principal weakness of this governance model is its elimination of a strong linkage between the laboratories and an agency of the executive branch. For the nuclear weapons laboratories, such linkage is clear: we have a primary mission responsibility to the DOE Assistant Secretary for Defense Programs. In the absence of such linkage, the ability of the laboratories (in the role of FFRDCs) to assist DOE in program planning and management would diminish greatly. As a result, the laboratories would likely lose their mission focus.

We believe a more practical approach to addressing the root problems identified in the Galvin Report would be to rejuvenate the GOCO relationship along the lines suggested by Appendix B of the report. In addition, a Laboratory Operating Board should be created, as presently being planned by DOE, which would incorporate many of the features of the Galvin model: distinguished leaders, staggered terms, and so forth. The Board would also include senior DOE management along with the outside members, and be chaired by the Under Secretary. Such an approach could achieve the benefits of the Galvin governance recommendations, provided it is embraced by senior management throughout the DOE complex.

6. Conclusion

Sandia National Laboratories has a central and critical role to fulfill in DOE's stockpile stewardship and management program. We must assure confidence in the stockpile surety and reliability and help DOE create an effective and efficient production complex for the stockpile of the future. We must offer the technical vision and engineering leadership to provide for long-range support of the enduring stockpile as it ages and as old technologies are superseded by new ones. In addition, we must furnish a robust core capability in the scientific and engineering disciplines required to respond to emerging and unforeseen challenges relating to nuclear weapons. To ensure this, our greatest challenge is to maintain a motivated and technically competent staff. To meet this challenge, we stress the importance of the nuclear weapon stockpile to National Security and continually mold our nuclear weapon work to provide technical challenges which deliver real, added value to the nation's security.

We vigorously support DOE's strategic vision and plan for Defense Programs through 2010. The ADAPT (Advanced Design and Production Technologies) and ASCI (Accelerated Strategic Computing Initiative) components of this strategic plan are formidable technical challenges that will engage Sandia in a major way. Our own planning as a laboratory, including support of these and other major initiatives contained in the Defense Programs plan, is predicated on Congressional support of the funding requirements of the DOE plan over a period of several years. A sustained, predictable investment, at a level above that of the immediate past, is essential if we are to stabilize the program and establish a sound, long-term infrastructure for stockpile support.

Senator KEMPTHORNE. Doctor, thank you very much.

Let me acknowledge and welcome Senator Exon, who is the ranking Democrat member of the committee, who, for some time, was the chairman of this subcommittee and provided outstanding leadership. His continued leadership is most welcome. Senator Exon.

Senator EXON. Mr. Chairman, thank you very much. I wish to apologize to you and to this distinguished panel that I have been tied up on budgetary matters today, and I apologize for not being here. This is a tremendous panel that you have brought in today, Mr. Chairman. It has brought to us a lot of knowledge that I hope you can impart to us on many of the questions that we have.

To allay your concerns, Mr. Chairman, I want you to know that I was in budgetary discussions all day today, and since I had your proxy, I only had to use it twice on controversial issues. [Laughter.]

I hope you did not have to vote on anything controversial here today.

In any event, I appreciate very much working with you on these matters, as we did before, over the last several years.

I have just a short opening statement that I would like to make to kind of put this into the perspective of the way I see things.

We all know that there are many problems confronting the Department of Energy and the national laboratories today, more so than ever before, I suggest. These range from the desire by some in Congress to abolish the Energy Department to those who would keep it but simply divert much of the Department's clean-up funding to other, supposedly higher priority programs. This concerns me.

Then there is the question about the supply of tritium, an ongoing concern to ensure the maintenance of our deterrence, and questions about ensuring the safety, reliability, and maintainability, as well as the possible need to refurbish and remanufacture major components of the nuclear weapons we will retain in our stockpile for the foreseeable future.

There are questions about the dismantling of older, nuclear weapons that are no longer needed. There are questions about what to do with the special nuclear materials that are generated by this dismantling process. Truly, it is much harder to put the genie back in the bottle or in any other container, once it has been freed, as you all know very well.

Gentlemen, one of your main problems is—and I know that this will "shock" you—that Congress is not a very patient body. We may or may not be the world's most deliberative body. But once we have decided after deliberating, we demand action right now.

We have wanted a new tritium supply since the mid-1980s, and it has not been forthcoming. The Department first proposed a New Production Reactor, then a two reactor strategy. Both proposals floundered.

We have wanted the worst sites across the production complex to be cleaned up for a long time. We have provided lots of money, even by our own standards of what constitutes a "lot"—somewhere in the neighborhood of $23 billion to date.

Yet, the amount of real cleanup seems to be relatively small.

For years, many of us have asked the question about the SDI program: what did we get for the $32 billion we spent? You should expect some questions about this, and more frequently they are going to be asked in the future about the cleanup program that I remain very much concerned about. I am sure the chairman, from our past activities, is concerned about this also.

I hope that I will not be repetitious and I am sorry that I missed the closed session. I have been advised, though, that there are some questions for clarification purposes that I might be asking. If we get into an area where answers should not be stated now, please say so. But I think some of the things that were said in closed session could be said here. So any questions that I ask, I will fully understand if you say they should not be discussed in this open session.

But before I get into any of those, let me ask if any of you has any specific information with regard to the newspaper story that I saw either today or yesterday with regard to the new nuclear test that was conducted in China.

As Dr. Smith and many of you know, we have been working for a long, long time, and I support and salute the administration for being successful in the United Nations with the Nonproliferation Treaty. I think that is a tremendous step in the right direction.

I don't know how long, though, we are going to be able to go on. I have been one who wanted to stop and not begin nuclear testing again. We are still following that policy, which is a wise one.

But can you tell us, do you know anything that you can reveal in open session with regard to what kind of test was it that the Chinese went through? Was it significantly different than the one they conducted, I guess, about a year ago now?

Where are we and what have they told us, if anything, about what is going on there.

Mr. BAKER. I can answer that, Senator Exon.

China has conducted many tests so far. They have conducted one in 1993, two tests in 1994. The yields on these were estimated to be between 10's of kt and over 100 kt.

Senator EXON. Are all these underground?

Mr. BAKER. Yes, sir, we believe they will conduct additional tests. Last weekends test we think was quite large.

We expect them to conduct additional tests. The Chinese say they support a Comprehensive Test Ban Treaty, and will stop testing once a Comprehensive Test Ban Treaty is in effect.

These tests appear to be focused on modernization of the Chinese nuclear forces, which include both the warheads and planned new delivery systems.

But I guess we, we—this is personally—I was a little shocked when they tested so soon, right after the Nonproliferation Treaty was signed.

I need to stop on the rest of it, sir. It should be for closed session.

Senator EXON. I understand.

But, you know, this concerns me a great deal. In open session, we cannot go into it any more than this. Suffice it to say with the continued testing of China and China only, it just makes it much more uncomfortable for the rest of the nuclear world.

I take it that you cannot be specific, in open session, at least, with regard to whether or not these tests could be described very likely as testing for safety? It could be more than that? Is that a fair conclusion of what I heard you just say?

Mr. BAKER. Yes, sir. It could be more than that, and we can provide that in closed session.

[The information follows:]

[Deleted.]

Senator EXON. Could you say in open session an answer to this question? Does the last test suggest that the Chinese are perfecting thermonuclear warheads for missiles? You made some allusion to that. Can you go any further in open session?

Mr. BAKER. That is as far as I can go right now, sir.

Senator EXON. Thank you very much.

If I might, Mr. Chairman, I would go into one or two other areas that I think are important.

Senator KEMPTHORNE. Certainly.

Senator EXON. First, I was very, very much interested, Mr. Baker, in your comments about what you found in the Soviet Union. You know, that is shocking information. If you saw this at that one facility, then I am fearful that there are many other facilities in the Soviet Union that might be in the same second or third class state with regard to really no security at all for that kind of materiel.

Do you think that there are many other places that are as bad as that?

Mr. BAKER. Yes, sir. We have given that information in closed session.

I learned a long time ago, Senator Exon, when you recognize a problem. I went to graduate school in Lincoln, and they had a governor at that time named Governor Exon. So I had good professors and good leadership.

Senator EXON. I finally found somebody that amounted to something. [Laughter.]

Mr. BAKER. I had good professors at Lincoln and I had a good governor. I recognize when you have a problem that you tackle it. With Under Secretary Curtis' guidance and the labs in partnership, we are tackling this problem in a big way.

It is a serious problem. And, as I said in closed session, it is not a Russian foreign aid problem. It is protection of this country. We need to do something about it, and the Department of Energy is doing something about it. We are going straight ahead as fast as we can to make sure that these facilities are fixed, and fixed right.

We are trying to encourage an indigenous Russian program, that the Russians will be able to do this after we show them how to do it.

Senator EXON. The reason I wanted to get into this, Mr. Baker and gentlemen, is just for the sake of putting it on to the public record. We all hear that foreign aid is very bad. Well, Nunn-Lugar is not foreign aid. It is aid to the United States of America in a foreign country that concerns us very, very much.

The statement that you gave, I hope the press will report on it very vividly. When you go into a storage facility and find highly enriched uranium, as I understand it, in an athletic type locker with only a padlock on it, there is a problem. There were no tennis shoes but plenty of highly enriched uranium. Is that right?

Mr. BAKER. Yes, sir. Mr. Curtis was there. That's right. There were no tennis shoes, but highly enriched uranium. Yes, sir.

Senator EXON. Well, that should wake up everybody in the U.S. Senate and the House of Representatives to what a serious situation we have over there. This is for Dr. Curtis or whoever would like to respond. Was the reception you received from the Russians totally cooperative?

Mr. CURTIS. Senator, let me try to put this program in somewhat of a perspective.

For a number of years, under the Nunn-Lugar program, we have sought to engage the Russian Federation and other of the former Soviet states in cooperative work to improve material protection, control, and accountability.

Those government-to-government relationships had been very difficult to mature because the import of the political judgment on the governments of the former Soviet states was a very significant, if you will, decision requiring all levels of approval in the government.

Through the initiative of our laboratories in the scientific cooperation with the institutes of the Russian Federation, indeed the former Soviet Union, we essentially provided a different avenue to begin to get improved material protection, control, and accountability of these weapons capable materials.

This is the product of the trust that developed through the scientist to scientist working together. These are scientists that, after all, understand the dangers associated with these materials better than anyone in the world and have a sense of responsibility that these materials be secure.

What we have done in the Department of Energy is nurture that laboratory to laboratory initiative, first with $2 million seed money in 1995. Through the good work of our principal weapons laboratories, we have been able to evolve a program now that we are seeking funding at a $40 million level in our fiscal year 1996 budget.

We have also received $15 million from Nunn-Lugar for fiscal year 1995. That marries up with our industrial partnering program that seeks to engage the weapon scientists themselves in useful, other work, if you will, transferring technological capability out of their laboratories into useful commercial work.

By engaging their scientists and getting better access to and control on this nuclear material security, we believe we have what I have called an urgent opportunity, an opportunity that has been created by the initiative of our laboratories that has some sense of urgency, because this is a very, very serious problem that poses a clear and present danger to the security of this country and to the security of the world.

Just to give you a perspective, Minatom, which is the civilian agency counterpart to the Department of Energy, if you will, in Russia, asserts that they have produced in excess of 1,000 metric tons of highly enriched uranium.

Under International Atomic Energy Agency (IAEA) thresholds, 25 kilograms is sufficient to make a nuclear device comparable to that exploded in Japan. That's 25 kilograms—about 50 pounds. We are talking about a universe of material potentially the size of 1,000 metric tons of highly enriched uranium in a comparable and very significant—not comparable to those metric tons—but a very, very significant amount of plutonium.

Getting that material under better protection and security is an urgent matter for this country. And this opportunity is one that deserves your full support and encouragement.

Senator EXON. Thank you. My great friend, the Chairman of this committee, has entered the room. It reminded me of a trip that we made to Chelyabinsk 65.

Have any of you or your fellow scientists been at Chelyabinsk 65?

Mr. CURTIS. Dr. Hecker has.

Dr. HECKER. I have been in Chelyabinsk 70, next door. Our scientists have visited 65 also.

Senator EXON. Is the situation not as bad there as it was at the site that you mentioned?

Dr. HECKER. It is indeed not as bad, and the reason being that the nuclear weapons facilities are still very heavily guarded and fenced in.

Senator EXON. That is what we saw.

Dr. HECKER. That is correct. And so, even though they have much more nuclear material, they are still guarded. The civilian institutes, such as the one Mr. Baker indicated, actually are short on guards and fences as well and are the most immediate problem.

Senator EXON. One last, quick question, if I may, Mr. Chairman.

I am just wondering. I have talked to our mutual friend, Dr. Viktor Mikhailov, whom most of you know or have met. He is a very interesting character. He has assured me time and time again, although I don't suppose he is under the direct control of this, but he has assured me time and time again in our conversations that all of this material is closely guarded and in good shape.

I think that Viktor would be surprised from what he told me about what I am learning today.

Is Dr. Mikhailov playing the same role that he has played since Russia became Russia?

Mr. CURTIS. If I might hazard a response to that, Senator, I think that what we have here is an opportunity to cooperate with the Russian institutes and with Minatom to help provide greater assurance for the safety and security of these materials.

What should be recognized is that the system of security that the former Soviet states previously relied on was guards, guns, gates, but a surveillance system in force through the Communist Party and restrictions on movement.

The latter two have fallen away, creating a very significant security gap. And, therefore, we propose to fill that security gap with technology and inventory controls which are mechanisms for assurance that we have always incorporated into our system.

So this is one area where we can really help reinforce the needed assurance mechanisms for the Russian Federation and the other Soviet states.

Senator EXON. Does Dr. Mikhailov understand all of this and does he continue to be cooperative?

Mr. CURTIS. I think it is important to note that both Presidents Clinton and Yeltsin at this last summit made as an important element of their announcement to give greater vigor, support, and sense of urgency to these activities in cooperation between both nations

Senator EXON. I am glad to hear that.

Mr. CURTIS. So I think that recognition is likely to be well distributed throughout the Russian Federation.

Senator EXON. I talked to Dr. Mikhailov about that very thing the last time I saw him and he said he was going to pass it along to the President. Thank you very much.

Dr. SMITH. Senator Exon, may I respond very briefly to your statements on Dr. Mikhailov?

As you know, we both share the pleasure of working with him. We are making steady, but slow, progress with him and with his bureaucracy. It is never easy.

But I do want to assure you that there is steady progress.

Senator EXON. Thank you. Thank you, Dr. Smith.

Senator KEMPTHORNE. Senator Exon's 5 minutes have expired. [Laughter.]

Senator EXON. My 6 or more minutes have expired. Thank you. [Laughter.]

Senator KEMPTHORNE. I would like to welcome the Chairman of the Armed Services Committee, Senator Thurmond.

Senator Thurmond, if you have some questions, we would welcome them.

Chairman THURMOND. Thank you very much. I have just about three questions.

I am glad to see you and Senator Exon today. I have worked here in the Senate for many years with Senator Exon, and I have been highly impressed with you as a comparatively new Senator. It is a great job that you are doing and I want to commend you.

Senator KEMPTHORNE. Well, thank you very much.

You may have 10 minutes. [Laughter.]

Chairman THURMOND. Mr. Curtis and Dr. Reis, the multi-purpose reactor takes care of two DOE missions—tritium production and plutonium disposition.

That's correct, isn't it?

Mr. CURTIS. You could combine those missions in a multi-purpose reactor. Yes, sir.

Chairman THURMOND. It also generates electricity revenues, which offset future Federal outlays, which tends to ameliorate our serious budget deficit problem. Is that correct?

Mr. CURTIS. Let me step back, Senator, and put this in context because it is important for me to be clear in my statement.

At the Department of Energy, we are evaluating various alternatives for meeting our tritium production requirement. We are aware of two proposals to meet our tritium production requirement through something called a multi-purpose reactor, that would combine electricity sales, tritium production, and plutonium disposition.

Those plans that have been submitted to us differ in content and approach. So in concept, a multi-purpose reactor can perform all three activities—sell electricity in the civilian market, produce tritium, and dispose of plutonium that is excess to our national security requirements.

I should say to you, however, that I have significant questions concerning the mixing of these missions that I believe deserve careful evaluation from both the standpoint of cost and the feasibility of meeting our tritium responsibility when you mix in the plutonium disposition mission. This is something I would urge this committee to give very careful consideration to in evaluating proposals for a multi-purpose reactor.

Chairman THURMOND. Again, I want to ask you the question. The multi-purpose reactor, though, does produce electricity?

Mr. CURTIS. It certainly can. Yes, sir.

Chairman THURMOND. That's what I mean.

Mr. CURTIS. Yes.

Chairman THURMOND. Now why is DOE even considering the high risk accelerator option, which consumes electricity, to produce only marginally enough tritium to meet the pre-Nuclear Posture Review, START II, and doing the stockpile tritium requirement?

Mr. CURTIS. Well, Senator, as you know, we are evaluating the technology options, including the site location for meeting our tritium responsibility. And the multi-purpose reactor is one of those options.

In the case of the accelerator production of tritium, that is another one of those options. In evaluation of it, we will both consider the technology risk as well as the cost.

On the technology risk, we have received testimony in closed session today, but it is testimony that is perfectly appropriate for open session, to the effect that the technology risk with tritium is not considered significant from a technology standpoint.

The question associated with using an accelerator for the production of tritium involves scaling that technology up to serve as a production machine.

The plan under evaluation includes a component that would prove out that engineering design requirement before proceeding on an accelerator as the Nation's source, new source, for tritium production.

Chairman THURMOND. The accelerator produces no electricity, does it?

Mr. CURTIS. No, sir, it does not produce electricity.

Chairman THURMOND. The multi-purpose reactor, I repeat, then, does tritium production and plutonium disposition. That's clear. You said that.

Mr. CURTIS. Yes. Let me tell you what the problem is, if I can, in mixing these missions.

Chairman THURMOND. I'm not mixing anything. I know what I'm talking about.

Mr. CURTIS. Oh, I understand. But I mean by "mixing the mission" doing both tritium and plutonium disposition in the same facility.

To dispose of the 50 metric tons of plutonium that is declared surplus to our national security requirements and to do that over 25 years would require two 1,350 megawatt reactors. That is 2,700 megawatts of power. That will produce a lot of electricity. But that is also much, much more reactor capacity than we require to make tritium.

So if you decide you are also going to dispose of plutonium and make tritium at the same time, you invite two reactors, 2,700 megawatts, instead of a 600 megawatt reactor, which is all that is required to produce tritium to our new requirements.

So, in my judgment, that is a significant complication on the tritium production mission.

Now to do that in order to "improve the finance ability" of the reactor is also a significant question. The proposal that has been submitted to the Department asks that the Department fund at a cost of $50 million, a feasibility study over the next 3 years to determine whether this, in fact, can happen.

Now I think this committee has to ask itself whether it wants to direct an investment over the next 3 years to determine the feasibility of this approach when it has been this committee's consistent demand that we get on and select a tritium production source.

Chairman THURMOND. Now the Nuclear Weapons Stockpile Memorandum, the NPR, requires DOD and DOE to decide on the source and production program for tritium. It states that in order to have an up-load hedge in case events require it, an accelerator decision will be needed.

What is the schedule for the accelerator decision, as contrasted with the pre-NPR schedule? And what is the accelerator site selection schedule?

Mr. CURTIS. The schedule that we are on contemplates a decision on the selection of a technology and, presumably as well, the selection of a site in November of this calendar year.

At any time prior to that, the Secretary may identify a preferred option as to both. But she is not obligated to do so.

Chairman THURMOND. Mr. Curtis, would not the leverage of the multi-purpose reactor technology enable DOE to make enormous budget savings over the years by producing electricity while dealing with two of your major program requirements, tritium production and plutonium disposition?

Mr. CURTIS. Senator, I think that has been asserted and it is a fair question for us to inquire about and for this committee to inquire about. To this end, we are doing a full and expanded cost study that will be completed on or about June 30 and obviously will be available to this committee for its consideration.

That cost study is specifically looking at the multipurpose reactor. We have held back the report on the multipurpose reactor until we have those cost data.

Chairman THURMOND. The experts I have talked to indicate that what I have said can be accomplished that way. So I hope you will give it your most careful study because that appears to be a very sound thing, to produce the tritium and to dispose of the plutonium.

Also, the Southeast needs electricity. The power companies are ready and willing to buy this electricity. They want it. They need it. And this will give more money to the budget. Thank you very much.

Mr. CURTIS. Thank you, sir.

Chairman THURMOND. Thank you, Mr. Chairman.

Senator KEMPTHORNE. Senator Thurmond, thank you very much.

Mr. Curtis, Dr. Reis, Dr. Smith, how will decisions on the confidence in the stockpile be made and communicated to Congress? Who will determine if confidence is lacking? And will we know when confidence is lacking and an underground testing recommendation is being made to the President? Mr. Curtis?

Mr. CURTIS. Well, first of all, let me emphasize that the Congress has set up a structure to supervise the management of the nuclear weapon deterrent, and that is the Nuclear Weapons Council which, by statute, is chaired by the Under Secretary for Acquisition of the Department of Defense. It includes the Vice Chairman of the Joint Chiefs of Staff and a designee of the Secretary of Energy. I am the current designee to the Weapons Council.

The Executive Director, by statute, of the Weapons Council is the advisor to the Secretary of Defense on Atomic Energy, which is Dr. Smith.

Under Dr. Smith there is a professional staff that assures coordination between the two departments so that there will be a full amplification of any questions concerning the confidence of the stockpile. And I believe Dr. Smith is the better person to speak to that because he administers this responsibility on behalf of the Weapons Council.

Senator KEMPTHORNE. All right. Dr. Smith.

Dr. SMITH. Mr. Curtis has described the Nuclear Weapons Council very well. In the future, without tests, we will ask for two independent reviews of any weapon—in fact, we will ask for such reviews of all weapons—to establish a baseline.

In those cases where the stockpile surveillance gives reason, gives cause for concern regarding the reliability, safety, or security of any weapon, there will then be independent reports generated on what is the problem and how can it be fixed.

Those reports will go to DOE through the Project Officers Group, which was mentioned earlier. Each Project Officer Group is a joint undertaking between the two departments. It includes military personnel.

Both reports will come to my office. And, as I have said earlier, the DOD has to be more educated than it has been in the past so that we can evaluate the reports. If they are both the same, fine. If they are different, we have to be able to judge the significance of any difference that exists.

The results of these reports will then be taken to the standing committee that Mr. Curtis has described. That will be the basis, then, for taking them to the Nuclear Weapons Council, which he has already described.

If we should decide at the Weapons Council that the weapon needs repair, needs refurbishment, should be thrown out and, therefore, remanufactured, as necessary, those decisions will be taken at the council and then forwarded to the two secretaries, the Secretary of Defense and the Secretary of Energy.

Presumably, in the event that testing seemed to be the only way—and I sincerely doubt that that would be the recommendation—clearly that decision would have to go to the President himself.

At many stages along that path, certainly at the Nuclear Weapons Council stage, we would be most pleased to invite the congressional leadership in to discuss a matter of that significance.

Senator EXON. So you would initiate, the Weapons Council would initiate that invitation to Congress so that we are aware that there is now a confidence question with regard to the weapons?

Dr. SMITH. I cannot speak for Mr. Kaminski, who is the chairman of the council. But I would hazard the guess, sir, that we would certainly want to invite the congressional leadership in to a decision of that magnitude.

There is one more point here that I think should be covered in answering your question, and that is who actually certifies a weapon. That is a DOE responsibility, and Dr. Reis will probably address that.

Senator KEMPTHORNE. Dr. Reis?

Dr. REIS. The certification process is really done not just at the DOE headquarters but it also involves the DOE laboratories. The directors of the laboratories independently have to certify that the weapons themselves are safe, secure, and reliable.

Let me just use your question to get back to the remarks that were made in the opening statements by the laboratory directors. The keys to making this happen are several. First, it is a cooperative process between the DOD and the DOE. It isn't just one versus the other. We work together on that. I think we have worked quite a bit over the past year to make that process work, if you will, at the level of the people who have their hands on the individual weapon itself.

Second, it does require vigorous teams who are both the designers of the weapons and other, equally expert, designers to work on those systems. That is why I think it is important that we maintain both our design laboratories as full service laboratories. It is very important to our doing this.

The third thing, of course, is the people themselves. We really do need the experts who have the knowledge and the commitment to continue working in this area. If you will, that is the guts of the stewardship program that we are starting in 1996. It is not just the weapons, but it is the people behind those weapons that each of the laboratory directors discussed who we feel are so important to maintain.

Senator KEMPTHORNE. So in the event that it is determined that there is confidence that is lacking in a weapon the Weapons Council may or may not contact Congress and notify them of the lack of confidence and that an underground test may be recommended. Is that correct?

Dr. SMITH. Mr. Chairman, I think that is getting ahead of what our decision making is in this new world of an aging stockpile without benefit of test.

Let me take that question for the record. It deserves an answer. But I would much prefer to discuss it at the very least with my management, not to mention my partners in DOE, before providing an answer to such an important question.

Senator KEMPTHORNE. Okay. I appreciate that.

[The information follows:]

NOTIFICATION OF CONGRESS IN THE EVENT OF A NUCLEAR WEAPONS COUNCIL RECOMMENDATION TO RETURN TO UNDERGROUND TESTING

The current Council charter includes a specific requirement for an annual Chairman's report to Congress. In the event that the Nuclear Weapons Council decided—at some time in the future—that underground testing was required to determine the safety or reliability of a stockpile weapon, the Council would forward this recommendation to the Secretaries of Defense and Energy. These Cabinet level officers would have the responsibility to report this finding to Congress and the President. The Council would also include this finding in its annual nuclear weapon surety report to the President and the Council Chairman's annual report to Congress.

Senator KEMPTHORNE. Mr. Curtis, DOE does 1 year budgets, and yet, any proposed stockpile stewardship plan must, by its very nature, be multi-year in its investment. How does DOE propose to insure a long-term, adequately funded Stockpile Stewardship Program?

Mr. CURTIS. I think the fair answer to that, Senator, is that first the 1996 budget represents, I think we will all acknowledge, an increase of some 9 percent in some very, very difficult fiscal times.

This is an important start on our Science-Based Stockpile Stewardship Program. We do not have the capacity to come before this committee and define our out-years beyond fiscal year 1996 for carrying that Science-Based Stockpile Stewardship Program to conclusion. We expect to be informed in the deliberations of the Congress on this this year. But I think we all recognize that our capacity, both to plan and to specify out-year commitments, is rather restricted.

We believe that in fiscal year 1997 we will have the guidance and the reference points sufficient to lay it out in a complete form. Part of those reference points are the outcomes of our Galvin Task Force implementation activities and other efforts to take some of the cost out of our system, both in the direct cost of the Department and the indirect costs that we impose on our laboratories through our management system.

Senator KEMPTHORNE. But, Mr. Curtis, isn't it accurate that in the proposal for fiscal year 1997 that we do see large budget cuts in the atomic energy defense activities?

Mr. CURTIS. What you see are large budget gaps. But what we are not able to show is that we have the top line authority assigned to these programs sufficient to meet what our planning estimates of requirements are. We have to find a way of closing that gap.

Senator KEMPTHORNE. Okay. Mr. Curtis, continuing this, then, can DOE support a stockpile that allows full reconstitution of existing weapons, whether under START I or START II conditions?

Mr. CURTIS. We can support a stockpile—well, let me back up. Obviously, it depends on the disposition of the Congress whether we will be given adequate funds to support a reconstitution, if I can use your term, to START I levels, or at least the hedge strategy that is stated in the Nuclear Posture Review. We have the capabilities to support START I levels if we are asked to go back to that stage. There will be difficulties in doing it, aberrations in certain years, depending on when the hedge requirement is imposed on us.

But what we should all recognize is that the Department lost its production capability back several years ago, not just as a consequence of the START I/START II negotiations, but it lost it because its production capabilities were basically shut down because of safety and environmental concerns; so that when you use the term "reconstitution," let me convert it to say "support START I levels."

I think we can support START I levels over time, given adequate notice and funding.

Senator KEMPTHORNE. Dr. Smith, do you feel that DOE currently has the capability to meet what you may project to be the DOD needs in the weapons stockpile?

Dr. SMITH. What I am most appreciative of, Mr. Chairman, is that there is agreement on what the goals are.

Mr. Curtis has said, quite accurately, that we must retain for the foreseeable future the ability to return to START I.

While we agree on the goal, we may or may not agree on the plan by which we will get there. Therefore, it is very straightforward for DOD to conclude that we simply want to see the plan and even contribute to the development of the plan by which we can assure ourselves that we could return to a START I level with respect to warheads at a rate commensurate, or perhaps even faster, than we could—"we," the DOD—return to START I levels with regard to the vehicles that carry such weapons.

Senator KEMPTHORNE. Currently that plan does not exist? Is that correct?

Dr. SMITH. I have not seen it, sir.

Senator KEMPTHORNE. So, getting back to my original question, does DOE currently have the facility that it could meet what you may project to be the DOD requirements?

Dr. SMITH. Why don't I wait and see the plan, sir?

Senator KEMPTHORNE. Dr. Smith, am I overstating it if I were to summarize this whole situation by saying that we have, in your own words, the most aging stockpile we have had; that it is determined that these weapons have a life expectancy of 20 to 25 years; that we are now discussing a new technology so that we can avoid underground testing, and that that capability of computer modeling, what have you, may be ten years in the making; that we're seeing a gap in the atomic energy portion of the budget that would deal with this in the out-years; that there's a real question of the U.S. capability currently to manufacture or refabricate the weapons necessary so that we can—and, again, I will reference your terms—continue the nuclear deterrence which is the cornerstone of the peace?

Dr. SMITH. I will try to take those in order, sir.

First of all, the 20 to 30 years that you refer to is a design life. I would call your attention to the airplane industry, where we design airplanes to fly for so many hours or so many years. Many of those airplanes fly beyond that period.

The same is true of our satellites. So the design life should not be confused with death itself. Therefore, we don't know how long the weapons could last. We only know that the designers had in mind 20 to 30 years when they built them.

Senator KEMPTHORNE. Is there any analysis currently that would tell us that their life expectancy does go beyond the 20 to 25 years?

Dr. SMITH. I would have to defer to the experts to my left. But my understanding is that each year in our stockpile surveillance we reassess that question, and we will continue to do so according to SBSS, the Science-Based Stockpile Stewardship. We will continue to do so with more vigor in the future than we have in the past for the obvious reason, that we won't have the ability to test, to find out if deterioration is taking place.

If we have that thorough stockpile surveillance and if we have the ability to remanufacture, then it would seem to me that we can maintain the stockpile, as I said in my opening remarks.

But that depends on the disposition of Congress to provide the funds, the ability of DOE to do the planning and construct the facilities. It keeps coming back to the detailed planning that is necessary to build and maintain airplanes, to build and maintain satellites, to build and maintain nuclear weapons. The central difference here is that we have to be much more careful with regard to weapons because we cannot test them and because they are the cornerstone of our security.

Mr. CURTIS. Senator may I respond?

Senator KEMPTHORNE. Yes. But if I may first, as I pursue this, I respect every individual who is on this panel that is before us. This is not a problem that is the making of the individuals seated here.

I recognize that it has been in the making.

Dr. Smith, you put in some "ifs", and those are very large "ifs", because with an aging stockpile, it is not that from today we start the clock on 20 to 25 years. That clock started 10, 15, and maybe 20 years ago on many of those weapons, and now we are 10 years away from determining if we can come up with the technology to determine if there has been deterioration. And then there is real question about our capability for manufacture, remanufacture, and the startup time to do that.

So this, I think, is critically important. Again, I do not feel that I have overstated it. That is why I think this committee has a real responsibility to figure this thing out.

Dr. SMITH. Mr. Chairman, I applaud your summary. I would like to make only one correction, and that is the techniques we need to survey the present stockpile to see if there is deterioration exist today and are being done. Technology that is referred to in Science-based Stockpile Stewardship are techniques in the future, some of which will be applied to surveillance, but some of which will be applied to various tests that could be run on facilities such as DAHRT, development of codes that try to extrapolate from the tests that would be run on DAHRT, et cetera.

But I want to emphasize that we, DOE, are doing stockpile surveillance today using modern technology. They simply will have to do more surveillance in the future using ever more technology.

But please do not think that the surveillance waits for 10 years of technological development. It is going on today.

Senator KEMPTHORNE. With the level of confidence that you would like to see?

Dr. SMITH. With an adequate level of confidence, sir.

Without testing, the confidence in the stockpile has to erode, and confidence really should be understood around this table as what is our understanding of the reliability, et cetera, of those weapons.

That has got to go down. But it started at a very, very high level.

Will it erode to the point where I would be, has it eroded without test today to the point where I am concerned? No. I have said so, that I think the confidence in the stockpile was adequate. It will continue to erode at a slow rate.

If DOE and DOD do their job, that rate will be more than acceptable for the indefinite future. But the fact is we have to maintain an eternal vigilance through surveillance, through development of scientific tools, through careful plans for remanufacture, refurbishment, in order to maintain a stockpile with which we are satisfied.

Senator KEMPTHORNE. I need to turn to Senator Exon. But first, Mr. Curtis, did you have a comment you wished to make?

Mr. CURTIS. Yes. It is just a matter of emphasis because I think it is important. What Dr. Smith describes is a temporal process and problem. The judgment, I think collectively and uniformly held, is that there is confidence that the stockpile of today is safe, and reliable, and secure. And we have the challenge over time to develop proxies for testing, advanced surveillance techniques being prominent among those, to assure that that confidence is maintained at an adequate level, and we are fighting against time.

We have submitted to the Congress a Stockpile Stewardship and Management Program which lays out our approach and how we propose to accomplish that. We believe that this is a very well constructed and challenging exercise, but one that, if you have the opportunity to consider it, will basically persuade you that we are going down the right path to meet that need.

There is a secondary question, and that is the productive capacity, the capacity to fabricate weapons in substitution for those weapons that are now part of the stockpile. That is a plan that we have yet to evolve. That is a plan that we are working on and we expect to be able to develop it over the course of this next year.

Again, it is a matter of providing this committee and the American people through you, confidence that we meet our stewardship requirements, and it is also a matter of providing the Department of Defense confidence that we are meeting our stewardship requirements.

But this is not just something we are sitting around, by ourselves, trying to figure out what to do. We have gotten our laboratories very significantly involved and challenged to meet this significant duty.

As far as the fiscal gap, I want to add one thing to it. We believe that, through our combination of initiatives, that we will reduce the stated out-year requirements that you see in that budget, as we laid out, as we have described in our Stockpile Stewardship and Management Plan.

Whether we can fully close that gap is the question. So it is probably going to be something in between what you are seeing in the out-years at the top line and what the OMB targets are showing for us at the present moment.

Senator KEMPTHORNE. Thank you very much. Senator Exon.

Senator EXON. Mr. Chairman, I will have some questions for the record. I just want to ask one question of whoever on the panel can best answer it.

When did we conduct our last test at the Nevada Test Site? What year was that?

Mr. CURTIS. September 23, 1992.

Senator EXON. 1992?

Mr. CURTIS. Yes, sir.

Senator EXON. What is the situation today at the Nevada Test Site? Has employment been reduced there? Is it still in a condition that, should we find it necessary to test, we could begin and resume testing? And how much notice would we need?

What is the status of the Nevada Test Site as of now?

Mr. CURTIS. If I may say, and Dr. Reis can fill in, we are asking in our fiscal year 1996 budget for $208 million to support test readiness posture at the Nevada Test Site. There is under a presidentially directed requirement that the DOE have the ability to resume testing within a 3 year period.

However, I should note that we all acknowledge our capacity to maintain test readiness is a significant challenge for the Department because it asks us to maintain core competencies in an absence of a test environment. That is a very difficult challenge and one that we are trying to address assiduously. Dr. Reis?

Dr. REIS. I could not add much more to that other than what we are trying to do is to maintain not just the roads and the infrastructure, but have an active experimental program, both in the laboratories and at the test site, to maintain the skill level of the people. So if there ever was a time when we had to go back to testing, we would have a cadre of experienced people.

Senator EXON. And who could go back to work.

Dr. REIS. Yes, who could go back.

Senator EXON. Mr. Chairman, thank you very much. I have no further questions. But I will have some for the record.

I thank you for being here, gentlemen.

Senator KEMPTHORNE. Senator Exon, thank you. We appreciate greatly your help on this issue. Let me pursue for a few minutes more the question of confidence.

Dr. Hecker, last month you were featured in a series of articles in the Washington Post which dealt with the topic of "Rethinking the Bomb."

The article stated that the Secretary turned down your recommendation to continue underground testing to maintain stockpile reliability and safety. In fact, the article said that the Secretary rejected the recommendation of all the weapons lab directors on this matter.

Was this the first time in the 50 year history of the U.S. weapons program that the Federal official in charge has rejected the recommendations of the lab directors on a question of weapons reliability and safety?

Dr. HECKER. From my knowledge of the database, it was the only time that I know of.

Senator KEMPTHORNE. Any further insight that you can give me? Are there any further thoughts as you follow this line of questioning?

Dr. HECKER. Well, I think on the confidence issue, actually, from my standpoint it is quite straight-forward. And that is before this meeting with the Secretary, at previous congressional testimonies, I have always maintained that from a technical standpoint, the testing issue is a no contest issue, and that is that the cheapest and most effective way of assuring the stockpile, and particularly during the times when we were developing the weapons, was to test.

So the technical answer was clearly that testing is the best way to do that.

However, what the Secretary had to do was to take the technical input, along with the other input, such as worrying about nonproliferation treaties, et cetera, and she had to integrate our input with the others to make her decision.

But I never left any doubt from our standpoint as to what the most effective way of taking care of the stockpile was.

Senator KEMPTHORNE. Dr. Tarter, Dr. Hagengruber, any further comments on that issue?

Dr. TARTER. I just would say if I had been there at the time, I would have given exactly the same answer. Technically, it is a no contest. But that is not necessarily the basis on which decisions are made. But it is a clear yes or no in that sense.

Senator KEMPTHORNE. Thank you. With regard to our capacity or capability for manufacture, remanufacture, refabrication, are there comments from the lab directors?

Dr. HECKER. I would like to make some comment.

I am somewhat troubled by the discussion in that I personally feel quite confident with Dr. Reis' leadership that, by going in the direction of Science-Based Stockpile Stewardship, an immensely enhanced surveillance process, we will be able to assess what the stockpile actually does, and we will be able to come back to the Department of Defense, Department of Energy, and give our assessment of what that confidence level is.

However, the part that I am most concerned about is that we just have to recognize that the paradigm has changed immensely with our not having the production capabilities that we had in the past. And to think that you can just immediately spring those back into gear today, that is just not possible to do. And to make those decisions even today is probably not the wisest decision to make, because in order to gear up for a potentially large requirement, we will have to spend hundreds of millions of dollars to do that.

In the meantime, we are trying to develop this new paradigm of kind of an integrated manufacturing, limited manufacturing capability, trying to assess whether we can extend the lifetimes of the plutonium pits beyond. We feel quite comfortable at 25; we have had some out there for 30 to 35 years. If we can do 50, if we can do 60, it will reduce the requirements and the expenditures we would have to make now for plutonium facilities in the future.

So my own feeling is that we need to work this very closely together in order to reduce the investment. But I do not feel greatly comfortable at this point that we have all the answers to the questions that you have posed because the manufacturing complex, to a large extent, is not there anymore.

Senator KEMPTHORNE. I appreciate that. At a March 29, 1995 hearing before the House National Security Committee, we understand that the directors of the labs testified that the DOE weapons labs have the expertise to do cleanup at such places as Hanford and Rocky Flats.

Could you please tell me what experience your respective labs have had in the area of nuclear waste cleanup? What environmental cleanup technologies have your labs developed that may be suited to cleaning up Hanford or Rocky Flats?

How would you propose going forward with the cleanup task at Hanford or Rocky Flats if given the lead in this area? And what are your recommendations regarding the environmental compliance laws that you would have to deal with if given this responsibility?

Dr. HECKER. Roger, did you want to answer that? [Laughter.]

Dr. HAGENGRUBER. Actually, to do justice on that, Mr. Chairman, I really would like to submit an answer for the record.

Senator KEMPTHORNE. I would like you to.

Dr. HAGENGRUBER. Each of the laboratories has had experience. We have had less experience in nuclear cleanup, but even Sandia has nuclear materials and we have had to deal with nuclear problems. We have partnered with nuclear facilities—the Hanford facility, Savannah River facility, the Idaho facility, and various plants in the past—in both processes, in nuclear waste issues. We have had joint efforts. I think, at least from Sandia's point of view, the comment of our ability to support and assist in a much more aggressive R&D based approach to these issues is one that would only work through a teaming activity, not only with the sites but also with the other laboratories.

But I would like to do better justice by giving you something directly for the record.

Senator KEMPTHORNE. I appreciate that.

[The information follows:]

Thank you for the opportunity to comment on the appropriate role of the Department of Energy's (DOE) Defense Program (DP) laboratories in the cleanup of contaminated DOE sites across the country.

As you know, the primary mission of the DP laboratories is to implement the nation's nuclear policies through research, development, and testing related to nuclear weapons, arms control, and weapon surety. As multi-program laboratories, we also serve the nation by using our core competencies to make special contributions in other areas of national importance. One such area, which is also well aligned with a key DOE mission, is our work related to the environment.

We believe the labs should be used in a manner that maximizes our strengths and recognizes our limitations. Our strengths in the environmental area include solving challenging technical problems through innovative engineering and managerial solutions. We are currently applying these strengths to environmental operations at our own sites and to the development of new technologies that can be applied across the DOE complex. We recognize, however, that many routine cleanup operations can be more cost effectively performed by private contractors. Consequently, we strive to directly provide the high-value-added, systems engineering processes, strategic program management, the establishment of high impact approaches to complex regulatory and administrative actions, and innovative technology development. We typically partner with private companies to cost-effectively conduct hands-on operations.

DOE laboratories are already contributing to DOE's national cleanup program. For example, the recent report to Congress *(Annual Report to Congress FY94,* U.S. DOE, 3/1/95) by DOE/Environmental Management's Office of Technology Development (OTD) provides some representative metrics. This report refers to three OTD technologies being awarded national R&D 100 awards in 1994. The technology implementation section of the OTD report highlights seven additional examples of technologies implemented in FY94.

We are part of a laboratory system that allows us to form partnerships with other DOE sites. For example, our staff serve as team members on DOE/Savannah River-led technology focus areas addressing contaminated groundwater plumes and landfill issues and on the DOE/Hanford-led focus area on underground radioactive-waste storage tanks. We are members of a multi-laboratory DOE team to develop and apply robotics technology to DOE's waste management and environmental restoration actions across the nation. We work with Oak Ridge National Laboratory and a number of private companies in an Environmental Decision Support & Research Coalition to help bring improved decision and risk evaluation tools to decisionmakers for environmental cleanup actions.

These are just a few examples of our partnerships with other sites and the new technologies we produce that can reduce cost and risks in DOE's cleanup actions. We believe that it is appropriate for us to work closely with other labs and site contractors as we have done in the past, but that it would be inappropriate for DP labs to take over detailed cleanup actions at other sites. Our strengths reside in our innovative technology, management approaches, and system engineering solutions to challenging technical problems. We plan to continue this important work for DOE and the Nation through our role as innovative technology suppliers and as a resource for strategic environmental operational management approaches.

Senator KEMPTHORNE. As you say, to assist, as opposed necessarily to lead?

Dr. HAGENGRUBER. I think the issue is that it is like, I suppose, sports. We would like to have everybody jumping for the ball here. But the fact of the matter is I think the local site people have, in fact, the immediate problem. They have the issue of the public interface, they have the knowledge of the facility.

So I think that other laboratories can bring, and I think Sandia would be pleased to bring, whatever expertise they can. And in some cases, because of the size of the DP labs, we have a tremendous breadth of technology base. It is like an insurance policy—robustness.

This lends a lot of help to other sites in being able to tackle things in a team fashion.

I think our view would be through cooperation.

Senator KEMPTHORNE. I appreciate that.

Yes, Dr. Hecker?

Dr. HECKER. Senator Kempthorne, I would like to give you a bit of our experience and then also where I think we can contribute.

For instance, at Hanford, Los Alamos has been very intimately involved in trying to fix the problems with the tank that was giving us the greatest heartburn—and that is 101SY—with the hydrogen burping problem, in essence, in the tank. Los Alamos provided expertise all the way from the basic chemistry, as to why does the hydrogen evolve, to the physics modeling, as to how it evolves, to providing the engineering to go in and do a safety analysis on how to steer the tank so that the hydrogen would evolve continuously so that you could burn it off harmlessly.

So we have been involved in actually a significant way.

At Rocky Flats, I feel very strongly that the input of the laboratories is absolutely essential at Rocky Flats. The problem there is really the following, that it is not just an issue of cleaning up the Rocky Flats site, but at Rocky Flats it is really an issue of what to do with the residual plutonium that is there because of the production plant being shut down in kind of mid-stream in June of 1989, with everything stopping.

And so, Rocky Flats is in need of substantial expertise on plutonium and plutonium processing in order to get the plutonium out of the plant, not just to worry about the environmental remediation.

It is laboratories such as Livermore and Los Alamos that have the expertise to help solve the Rocky Flats related problems. So there I think it is extremely important. And we have actually made a lot of progress with Mr. Grumbly to offer our help in the Rocky Flats problem.

Dr. REIS. Senator, if I could, I would like to help Dr. Hecker with his hydrogen burping and heartburn. I have some Tums with me today. [Laughter.]

Dr. HECKER. Dr. Reis has offered up a set of Tums.

Senator KEMPTHORNE. You may wish to pass that around.

Dr. REIS. I don't want to have to tell you why I brought that to this hearing. [Laughter.]

Dr. TARTER. Perhaps I could add something here as part of the record, just for completeness.

Senator KEMPTHORNE. Dr. Tarter.

Dr. TARTER. At the March 29 hearing, when the question was asked, as you have from the transcript, I think Dr. Narath had the unfortunate position of having to answer the question first about whether he'd cleaned up. He said yes. I was next. Fortunately Dr. Hecker volunteered in front of me, so I was silent on the question you asked.

If asked, I think I was going to volunteer to clean up Los Alamos and not Hanford. [Laughter.]

However, I think what Dr. Hecker has said is half of the equation. I think Livermore in particular has had years of experience working with plutonium at our plutonium facility, and I think we have a great deal of expertise in both robotics and in the handling of plutonium in many environments.

I think also much of the processing work, both with the current AVLIS facility, and doing uranium handling and work, and the previous work on the Special Isotope Separation Program with plutonium, are all things which make doing this kind of work a natural for the laboratory.

The other piece I think we have done in great extensiveness at Livermore is worked very much with the regulators, with particular systems in doing the risk assessments. I think one of the things all the laboratories bring to this, which perhaps a different type approach does not, is to make assessment of risk, put the effort where the technology will pay off, and bring that approach to the system.

Given that, with the plutonium and the uranium capability, I think certainly the laboratories are well equipped. But I think you need an answer for the record, as Roger said.

Senator KEMPTHORNE. I would appreciate that.

I am going to have to leave. I know that disappoints you, [laughter] because of a vote that is going to take place.

Mr. Baker, I notice that the Tums are in front of you. I also note that not much of your budget is spent at the Idaho National Engineering Laboratory. [Laughter.]

Could you explain that discrepancy?

Mr. BAKER. Can I submit that for the record, sir?

Senator KEMPTHORNE. You certainly may.

Mr. BAKER. You know, sir, to answer your question——

Senator KEMPTHORNE. In 30 seconds or less.

Mr. BAKER. Yes, sir. We are trying to draw on 35 years of technical experience in all the labs, and we are trying to make it a level playing field.

Senator KEMPTHORNE. We would like to see some of that leveling come our way.

Mr. BAKER. Yes, sir.

Senator KEMPTHORNE. I want to thank all of you. You have provided excellent input and I know that some of the questions probably seemed a little hard-edged at times. But we need to get to the answer on a very critically important issue for the future.

So, again, I thank all of you. You have been outstanding.

This hearing is adjourned.

[Questions for the record with answers supplied follow:]

QUESTIONS SUBMITTED BY SENATOR STROM THURMOND

STOCKPILE SUPPORT

Senator THURMOND. The Department of Energy (DOE) must be capable of supporting and sustaining the enduring stockpile in a safe and reliable status. What do you mean by the "enduring stockpile" in this context? Provide numbers and breakout by weapons type for the active and inactive stockpile and their associated delivery systems. Relate to statements from the Nuclear Posture Review.

Dr. SMITH. We define the "enduring stockpile" to mean those weapon types that we expect to constitute the active and inactive stockpiles of nuclear weapons in the foreseeable future. The Nuclear Posture Review (NPR) defines the START II force structure for the year 2003. The strategic delivery systems projected to be in place in that year include: 14 strategic missile submarines (all with Trident D5 missiles by 2003), 66 B–52 and 20 B–2 bombers, and three wings of Minuteman Intercontinental Ballistic Missiles (ICBMs). These delivery systems will be fitted with the appropriate number and type of warheads. Specifically these warheads include: the B61 family of theater and strategic bombs, the W62/Mk12 Minuteman III ICBM warhead, the W76/Mk4 warhead carried on the Trident I C4 and Trident II D5 Sub Launched Ballistic Missile (SLBM), the W78/Mk12A Minuteman III warhead, the W80 cruise missile warheads, the B83 strategic bomb, the W87/Mk21 Peacekeeper ICBM warhead, and the W88/Mk5 Trident II D5 SLBM.

Dr. REIS. The enduring stockpile is currently defined as the following weapons:

Warhead	*Description*	*Delivery System*
B53	Strategic Bomb	B–52
B61–7	Strategic Bomb	B–52, B–1
B61–3,4,10	Tactical Bomb	Various attack and fighter aircraft
W76	Reentry Body	Navy Trident I (C–4) AND Trident II (D–5) Submarine Launched Ballistic Missiles (SLBM)
W78	Reentry Vehicle	Air Force Minuteman III Intercontinental Ballistic Missile (ICBM)
W80–0,1	Cruise Missile Warhead	Navy Tomahawk Cruise Missile, Air Force Air Launched Cruise Missile, Air Force Advanced Cruise Missile
B83–0,1	Strategic Bomb	B–52
W84	Cruise Missile Warhead	None (originally Ground Launched Cruise-Missile)
W87	Reentry Vehicle	Air Force Peacekeeper ICBM
W88	Reentry Body	Navy Trident II (D–5) SLBM

The actual quantities of each warhead are classified and will be provided separately.

Senator THURMOND. Will DOD require that DOE be capable of supporting the entire enduring stockpile, including both active and inactive weapons or will you simply require that DOE be capable of supporting only the 3,500 weapons which are projected to be in the active stockpile under the anticipated START II agreement?

Dr. SMITH. The Department of Defense will require the Department of Energy to provide support for both active and inactive stockpiles; however, the inactive stockpile is not maintained in an operational configuration.

Senator THURMOND. Will DOE be capable of supporting the entire enduring stockpile, including both active and inactive weapons or will you simply require that DOE be capable of supporting only the 3,500 weapons which are projected to be in the active stockpile under the anticipated START II agreement?

Dr. REIS. The DOE will support the stockpile authorized by the President in the Nuclear Weapons Stockpile Plan. The DOD has not yet defined requirements for support of the Inactive Stockpile beyond those previously noted for the Inactive Reserve. The DOE is currently not required to maintain Limited Life Components and tritium for the Inactive Stockpile.

NUCLEAR POSTURE REVIEW

Senator THURMOND. In his annual report to the President and the Congress, Secretary Perry states that "the Nuclear Posture Review called for an affordable hedge in which the approved force structure could support weapons levels greater than those called for under START II should major geostrategic changes demand it." Are you committed to this hedging strategy and to the need for the so-called "upload hedge"?

Dr. SMITH. I am committed to the strategy of leading and hedging, as defined by Secretary Perry in the Nuclear Posture Review.

Mr. CURTIS. The upload hedge is not currently authorized by the Nuclear Weapons Stockpile Plan and the DOD has not yet defined any requirements relating to this hedge. The DOE will support the hedge if and when it is defined and authorized.

NUCLEAR POSTURE REVIEW/UPLOAD HEDGE

Senator THURMOND. The Nuclear Posture Review refers to an "upload hedge" to which the United States could resort in the event that the geostrategic situation begins to deteriorate. How do you define that upload hedge, and what steps will you take to preserve it?

Dr. SMITH. The upload hedge is our insurance against a resurgent nuclear threat to the United States and requires the ability to reconstitute the nuclear weapon stockpile to a level commensurate with the START I Treaty. The inactive stockpile of nuclear weapons forms a central part of the hedge against adversity. DOD will continue to require DOE to assure the safety and reliability of the inactive stockpile.

Dr. REIS. The upload hedge is not currently authorized by the Nuclear Weapons Stockpile Plan and the DOD has not yet defined any requirements relating to this hedge. The DOE will support the hedge if and when it is defined and authorized.

DEPARTMENT OF ENERGY/NUCLEAR WEAPONS

Senator THURMOND. Will you require DOE to maintain the inactive stockpile, as well as the active stockpile, in a safe, reliable, and ready condition as the reserve for rapid implementation of the "upload hedge"? Will you require that both the active and inactive stockpile be fully supplied with tritium and fully equipped with limited life components?

Dr. SMITH. DOD requires DOE to maintain the inactive stockpile in a safe and reliable condition so that those warheads can be reactivated according to a DOD schedule.

STOCKPILE ISSUES

Senator THURMOND. Will DOE maintain the inactive stockpile, as well as the active stockpile, in a safe, reliable and ready condition as the reserve for rapid implementation of the "upload hedge"? Will DOE ensure that both the active and inactive stockpile be fully supplied with tritium and fully equipped with limited life components?

Dr. REIS. The DOE will support the hedge if and when it is defined and authorized. The upload hedge is not currently authorized by the Nuclear Weapons Stockpile Plan and the DOD has not yet defined any requirements relating to this hedge. The DOE will support the stockpile authorized by the President in the Nuclear Weapons Stockpile Plan. The DOD has not yet defined requirements for support of the Inactive Stockpile beyond those previously noted for the Inactive Reserve. The DOE is currently not required to maintain Limited Life Components and tritium for the Inactive Stockpile.

TRITIUM SUPPLY

Senator THURMOND. Do you believe that there is a need to press DOE to submit their decision on a reliable source of tritium to this session of Congress? Furthermore, if DOE selects the unproven accelerator technology, will you accept it or insist on proven reactor technology? What is the requirement date for tritium and how much tritium must be produced per year? Reference to specific numbers in the active and inactive stockpiles.

Dr. SMITH. The Record of Decision for the assured source of tritium is due from the Department of Energy by November 1995. A decision on this most critical issue cannot be delayed. The Nuclear Weapons Council, the Joint Advisory Committee, and the JASON group have already endorsed the strategy incorporated in Accelerator based Production of Tritium (APT) as a primary source of tritium. Regardless of the site or technology chosen as the primary source, a backup source of tritium using existing light water reactors is essential to provide stability and a hedge against unforeseen circumstances. The amount of tritium needed by the stockpile will depend on the size and composition of the stockpile itself. Current estimates of the expected "requirement date" for tritium—depending on the number of weapons in the stockpile—range from the year 2003 to 2011.

Senator THURMOND. Do you believe that there is a need for DOE to submit its decision on a reliable source of tritium to this session of Congress?

Mr. CURTIS. Yes. In accordance with the National Environmental Policy Act, the decision on a reliable source of tritium will be made 30 days after the Final Programmatic Environmental Impact Statement (PEIS) is completed. That final PEIS will be completed in October 1995, and DOE intends to announce the Record of Decision on a reliable source of tritium in November 1995. A decision at that time would ensure that any alternative chosen could be brought on-line to produce the tritium needed by 2011.

WEAPON MANUFACTURING

Senator THURMOND. The United States is presently the only nuclear weapons state which is abandoning its actual manufacturing capacity to produce nuclear weapons. Will you require DOE to restore the manufacturing capacity for nuclear weapons?

Dr. SMITH. The NPR requires DOE to demonstrate the capability to refabricate and certify weapon types in the enduring stockpile and maintain the capability to design, fabricate, and certify new warheads.

Dr. REIS. The DOE is following a strategic plan to reduce cost and infrastructure while supporting the Presidentially-authorized stockpile. Since the DOD has not specified any new warhead build requirements, the DOE foresees a smaller production complex, capable of supporting the remanufacture of the enduring stockpile.

WEAPON REBUILDING

Senator THURMOND. From his written statement, the Assistant Secretary for Defense Programs says that "improvements to the stockpile must be made through a strategy which does NOT call for significant new weapons production or complete rebuilding of the entire stockpile." What is the DOD position on this point? How can this be compatible with the Nuclear Posture Review requirement for a prompt upload, reconstitution hedge? What is the rationale for opposing a strategy which would maintain sufficient nuclear manufacturing capacity to rebuild the entire enduring stockpile as it begins to exceed its design life some 7 years from now?

Dr. SMITH. DOD's position is that the Department of Energy must be able to replace all warhead types in the enduring stockpile. The reconstitution hedge specified in the NPR will be provided by the inactive stockpile not rebuilt warheads. DOD is unable to identify a rationale opposing this strategy, however it is not clear if a fully operational production facility will need to be operational in 7 years.

Senator THURMOND. From his written statement, the Assistant Secretary for Defense Programs says that "improvements to the stockpile must be made through a strategy which does NOT call for significant weapons production or complete rebuilding of the entire stockpile". What is the rationale for this unsupported assertion? How can this be compatible with the Nuclear Posture Review requirement for a prompt upload, reconstitution hedge? What is the rationale for opposing a strategy which would maintain sufficient nuclear manufacturing capacity to rebuild the entire enduring stockpile as it begins to exceed its design life some 7 years from now?

Dr. REIS. There are two basic reasons for this statement. First, without authorization to conduct nuclear tests to certify new weapons, the DOE will rely on Stockpile Stewardship activities to maintain the stockpile and possibly to certify new weapons. Understandably, there would be less confidence in a new design which had not undergone nuclear testing, so maintaining currently certified warheads would be preferable. Second, the nuclear weapons production complex will be reconfigured and downsized to support the smaller stockpile. We expect to remanufacture weapons in the enduring stockpile, however, the production quantity will be much lower than that needed in the past.

DEPARTMENT OF ENERGY/WEAPONS PLAN

Senator THURMOND. Will DOD press DOE to produce a requirements driven, technically detailed plan for nuclear weapons stockpile stewardship and management? The May 1995 DOE plan to which you refer in your answer is neither requirements driven nor technically detailed.

Dr. SMITH. DOD is very interested in seeing a specific, detailed program plan and will encourage DOE to produce one as quickly as possible.

Senator THURMOND. Will DOE produce a requirements driven, technically detailed plan for nuclear weapons stockpile stewardship and management? When? The May 1995 DOE Stockpile Stewardship program description is neither driven nor technically detailed.

Dr. REIS. The DOE is preparing a requirements driven, technically detailed implementation plan for Stockpile Stewardship and Management. This plan, which will be prepared with input from the DOD, will identify specific milestones and planned activities necessary to achieve the vision for 2010 described in the May 1995 Stockpile Stewardship and Management Program document. This implementation plan is projected to be available in January 1996 and will reflect fiscal year 1996 budget decisions.

"LEADING" VS. "HEDGING"

Senator THURMOND. The Nuclear Posture Review showed where it was prudent to "lead" and how best to "hedge". In view of DOD's statutory mission, does that position require DOD to emphasize the "hedge" aspect of the strategy or will DOD emphasize the "lead" aspect?

Dr. SMITH. The NPR force structure is based on projected military requirements and the capabilities of the former Soviet Union. We do not target Russia (or anyone else) today but we must be prepared for the possible emergence of a hostile government in Russia or the failure of the arms control process in the former Soviet Union. As President Clinton has stated, "We will continue to maintain nuclear forces of sufficient size and capability to hold at risk a broad range of assets valued by such political and military leaders." The U.S. nuclear posture must not only help shape a future in which the role of nuclear weapons is reduced but also preserve options if reform in Russia fails while maintaining good stewardship of the Nation's nuclear deterrent. DOD supports the President's policy to both lead and hedge.

Senator THURMOND. The Nuclear Posture Review showed where it was prudent to "lead" and how best to "hedge". In view of DOE's statutory mission under the Atomic Energy Act, does that mission require DOE to emphasize the "hedge" aspect of the strategy? What is the statutory basis for DOE emphasizing the "lead" aspect by making its role in non-proliferation the DOE's first national security priority?

Mr. CURTIS. The Atomic Energy Act requires that the President approve the quantity and content of the nuclear weapons stockpile. The upload hedge is not currently authorized by the Nuclear Weapons Stockpile Plan and the DOD has not yet defined any requirements relating to this hedge. The DOE will support the hedge if and when it is defined and authorized. Until then, DOE must support the strategy as defined by the current Nuclear Weapons Stockpile Plan.

ROLE OF THE DEPARTMENT OF ENERGY

Senator THURMOND. Does DOE have a statutory mission to simply provide nuclear weapons as required by DOD or does it have as part of its statutory mission role the right to negotiate the size and nature of the nuclear stockpile with DOD?

Dr. SMITH. The two Departments share the responsibility to ensure the safety, security, reliability, and operational capability of the nuclear deterrent. The principal mechanism for DOE participation in these matters is the joint Nuclear Weapons Council, chartered by an act of Congress.

Mr. CURTIS. Section 91 of the Atomic Energy Act of 1954 authorizes DOE, among other things, to engage in the production of nuclear weapons or weapons parts only to the extent the express consent and direction of the President has been obtained, and also requires that such consent and direction must be obtained at least once a year. Section 91 further provides that the President from time to time may direct DOE to deliver special nuclear material or nuclear weapons to DOD for such use as the President deems necessary in the interest of national defense. In furtherance of these authorized activities, DOE, with the DOD, participates in the development of an annual stockpile recommendation for consideration by the President. Neither DOE nor DOD has a statutory right to negotiate the size and nature of the nuclear weapons stockpile, that decision is made by the President.

STATUTORY BASIS FOR NON-PROLIFERATION ACTIVITIES

Senator THURMOND. What is the statutory basis for DOD's role in non-proliferation?

Dr. SMITH. The Department of Defense traces its role in countering the proliferation of weapons of mass destruction to the Atomic Energy Act of 1954.

Senator THURMOND. What is the statutory basis for DOE's role in non-proliferation?

Dr. SMITH. The Department of Energy assumed its responsibilities in countering the proliferation of nuclear weapons from predecessor agencies, dating back to the Atomic Energy Act of 1954.

Mr. CURTIS. The Departments nonproliferation activities are derived from the following statutory authorities:

- Sections 302, 309(c) and 403(a) of the Nuclear Nonproliferation Act of 1978;
- Sections 54, 57b, 64, 82, 109, 111b, 123, 126, and 131, as well as Chapter 11 of the Atomic Energy Act of 1954 as amended;
- The Export Administration Act of 1979, as amended by the Export Administration Act of 1981 and the Export Administration Act of 1985;
- The Arms Control and Disarmament Act of 1961;
- The Arms Control and Disarmament Amendments Act of 1987; and
- The Arms Export Control Act.

POTENTIAL PROLIFERATORS

Senator THURMOND. Do you believe that other nations are motivated to acquire nuclear weapons by the existence of U.S. nuclear forces?

Dr. SMITH. Other nations have debated acquiring nuclear weapons since the original test was conducted over 50 years ago. Since the adoption of the Nuclear Nonproliferation Treaty, the number of declared or suspected nuclear weapons states has remained remarkably low. I believe that the United States has performed exceptionally well as a world leader in the continuing effort to reduce the political demand for nuclear weapons.

Mr. CURTIS. There is no direct correlation between the U.S. nuclear inventory and the desires of other states to acquire nuclear weapons. The historical record indicates that in some instances the U.S. possession of nuclear weapons has clearly stimulated nuclear weapons acquisition. In others, it has reduced incentives to seek nuclear weapons.

Early in the nuclear age, the Soviet Union, China, France and the U.K. were all motivated for reasons of security or prestige to seek nuclear weapons. The U.S. possession of them was very likely an important stimulus.

Later with the development of NATO, and the doctrine of massive retaliation, the so-called U.S. nuclear umbrella reduced the pressure for allied states to acquire their own nuclear weapons.

Today, there is no convincing evidence that U.S. nuclear forces significantly motivate foreign governments to seek nuclear weapons. If we examine the states of greatest nuclear proliferation concerns, it is apparent that they exist in regions of tensions and their activities result in very significant regional security concerns. These regional security concerns would exist even irrespective of the U.S. nuclear weapons stockpile.

DISMANTLEMENT

Senator THURMOND. Do you believe that the United States should continue to dismantle its nuclear stockpile without concrete evidence and verification that Russia is dismantling its nuclear weapons in the same amount and at the same rate?

Dr. SMITH. The Department of Defense has identified a number of weapons that it no longer needs today, nor will need in the future, to support its statutory nuclear mission. The Department of Energy is dismantling these weapons. The active and inactive stockpiles contain the weapons we require to meet current and contingency requirements as described in the Nuclear Posture Review. Regarding the Russian dismantlement program, we have opened a dialogue with the Russian government in an effort to increase the transparency of this effort.

Mr. BAKER. A broad consensus exists that within reasonable limits numerical discrepancies in U.S. and Russia strategic nuclear warhead stockpiles arising from different dismantlement rates do not represent a national security threat. The United States is dismantling only those nuclear weapons which are no longer needed to meet U.S. national security requirements. Both U.S. National Technical Means and START I Baseline inspection data indicate that the Russians are dismantling their nuclear delivery systems at a rate faster than required by the START I Treaty. Current Russian strategic launcher levels are already below the December 1997 treaty-required levels, and Russian deployed warhead levels have followed a corresponding downward trend. While we have no confirmed independent data on the aggregate size of the Russian strategic warhead stockpile we have high levels of confidence that the Russians are moving warheads to dismantlement facilities and removing fissile material from these facilities, which suggests a significant Russian nuclear weapon dismantlement rate. Until the level of strategic nuclear weapons in the U.S. stockpile approaches that called for by the START I Treaty, variations in U.S. and Russian warhead dismantlement rates are not considered critical factors in U.S. safety and security risk calculations. Under current planning for U.S. dismantlement of excess nuclear weapons, the United States will continue to maintain a strategic nuclear deterrent that can survive and respond to any conceivable attack, regardless of Russian dismantlement practices.

DOD MANAGEMENT OVERSIGHT OF DOE

Senator THURMOND. It has come to the attention of the Committee that the position of the Assistant to the Secretary of Defense (Atomic Energy) has been given several other responsibilities in the areas of non-proliferation, chemical weapons, and other weapons of mass destruction. That position is now able to devote not much more than a quarter of its time to overseeing the Department of Energy nuclear weapons program and working with the Joint Chiefs and the Nuclear Weapons Council to develop requirements for DOE. The committee is greatly concerned about this lack of DOD management commitment. What do you propose to do about this situation?

Dr. SMITH. My duties in the area of nuclear weapons are of primary importance to me. I am supported by an outstanding staff of military and civilian professionals whose expertise and experience in nuclear matters is exemplary. I am able to testify, as I have in the past, that the nuclear weapons stockpile is safe, secure, and reliable. I am committed to maintain this status.

SETTING DOD REQUIREMENTS FOR DOE

Senator THURMOND. At a recent meeting with high level DOD officials, the Secretary of Energy is said to have told DOD that she would not discuss nuclear weapons requirements with them. The Secretary is quoted as having said that the White House has set the U.S. nuclear stockpile at 3,500 weapons based on the pre-Nuclear Posture Review Stockpile Memorandum. That number is consistent with the number of active weapons allowed by the unratified START II Treaty.

Is it the appropriate, official responsibility of the Secretary of Energy to tell the Department of Defense the numerical requirements for the nuclear weapons stockpile? How will the Secretary of Defense respond to the Secretary of Energy? Who is in charge?

Dr. SMITH. The President, the Secretary of Defense, and the Secretary of Energy each has an important role in establishing U.S. nuclear deterrent policy. The President, as Commander in chief, has a legal responsibility to decide the number and types of weapons that are built and deployed to carry out that policy. The numbers and types of weapons are a result of a recommendation by the Secretary of Defense, in coordination with the Chairman of the Joint Chiefs of Staff. In turn, the Secretary of Energy identifies the resources required to meet the Department's nuclear force objectives. If, however, DOE cannot meet our requirements with available resources, it is incumbent upon the Secretaries of Defense and Energy to inform the President in order to seek additional resources.

INACTIVE STOCKPILE

Senator THURMOND. The DOE Stockpile Stewardship and Management Program brochure dated May 1995 does not identify any post-START II weapons in the stockpile beyond the 3,500 weapons that would be allowed if that treaty is ratified.

What is the size, status, and character of the inactive stockpile under this program?

Is there an inactive stockpile in this program? If so, why is it not explicitly addressed?

Dr. SMITH. The Stewardship and Management plan was developed internally by DOE and has not been formally presented to DOD. The President will determine the size and composition of the U.S. nuclear weapons stockpile.

Mr. CURTIS. The Stockpile Stewardship and Management Program document dated May 1995 does not set an upper limit on the total number of weapons in the active and inactive stockpile that the Department will be able to maintain. The size, status and character of the Nuclear Weapons Stockpile is defined by the Nuclear Weapons Stockpile Plan, which is authorized by the President. DOE cannot speculate on stockpile requirements beyond those defined by the Department of Defense and authorized by the President.

LOGISTICS OF THE UPLOAD HEDGE

Senator THURMOND. According to the Nuclear Posture Review, a nuclear weapons upload hedge above and beyond the 3,500 active weapons in the active stockpile (START II level) is required should the geostrategic environment deteriorate.

Can you describe the number and types of nuclear weapons in that upload hedge under DOE's responsibilities to support DOD?

To what readiness status will they be maintained? (Specify tritium supply, limited life components, when the weapons will be rebuilt, and how frequently they will be checked by the surveillance program.)

Dr. SMITH. The inactive stockpile forms a large part of the upload hedge against uncertainty in the post-Soviet nuclear world. Generally, that hedge encompasses our ability to augment our active, START II stockpile to one which would be compliant with the START I Treaty. The inactive stockpile of nuclear weapons is the basic building block of the upload hedge. DOD will continue to require DOE to maintain the inactive stockpile in a safe and reliable condition so that warheads sent to the inactive stockpile under the START II Treaty could be reactivated, if required.

Mr. REIS. The upload hedge is not currently authorized by the Nuclear Weapons Stockpile Plan and the DOD has not yet defined any requirements relating to this hedge. The DOE will support the hedge if and when it is defined and authorized.

STEWARDSHIP VERSUS TESTING

Senator THURMOND. DOE has pointed out that stockpile stewardship is not guaranteed to work and if it does work, it will be decades before one can reasonably assume that all of the complex data, hardware, software, and model development can be integrated into a coherent, precise, accurate, quantitative model of how a nuclear weapon will perform.

Wouldn't a strategy which involves some treaty compliant testing in DOE be a more prudent and far more reliable approach on which to base near term and long term stockpile confidence?

Dr. SMITH. As stated in the Nuclear Posture Review, the President has challenged the Department of Energy to develop a program which will help to assure a high level of confidence in the nuclear weapon stockpile in the absence of underground nuclear testing. The Science Based Stockpile Stewardship (SBSS) program is being developed to meet this challenge. The U.S. Government has not yet reached a decision on the nature of activities not prohibited by a Comprehensive Test Ban which would be required to complement the SBSS program.

Mr. REIS. The development of a calculational model that can provide such a complete and accurate picture of how a nuclear weapon will perform is a goal we are striving to achieve. This is especially true considering the level of sophistication of the designs in the U.S. nuclear weapons stockpile and the environments in which they are required to function. It has not been established what form of testing will be "treaty compliant" under a Comprehensive Test Ban Treaty (CTBT). If nuclear weapon related experiments were permitted that allow access to the nuclear phase of weapon operation then, clearly, the probability of successful development of more accurate calculational models would be increased. The Departments Stockpile Stewardship and Management strategy is based on those types of experiments that will be permitted by national policy under the nuclear testing moratorium. If a different regime is established under a CTBT, our strategy will be revisited.

STOCKPILE STEWARDSHIP AND MANAGEMENT

Senator THURMOND. The Stockpile Stewardship and Management Program appears to be driven by facility and computer acquisition (tools) rather than a deeper analytical strategy aimed at understanding what comprehensive set of physical models and physical data are needed to develop a sufficiently accurate physical model upon which to base stockpile confidence.

How do you respond to this?

Are the laboratories developing such an integrated strategy or are they working independently? If so, who's in charge?

Dr. SMITH. It would be impossible to understand the nature of an issue as complicated as the health and viability of the nuclear stockpile without having the right "tools." The real test of our ability to understand the stockpile will be reflected in how well we use these tools. The laboratories are an important factor in not only the development of these tools but also for their subsequent use in advancing our understanding of, and confidence in, the Nation's nuclear deterrent.

Mr. REIS. In the past, nuclear testing provided indisputable data on nuclear performance so that weapon scientists could express confidence in their designs despite known ambiguities and an admitted lack of understanding of several critical phenomena in their calculational models. Without the opportunity to conduct nuclear tests to confirm and improve our calculational estimates, it is necessary to rely on other experimental methods that provide data on the pre-nuclear phases of weapon performance (hydrodynamic testing) and phenomena that bear on other physical processes (inertial fusion). A key to maintaining confidence in the stockpile in the future is attracting and retaining knowledgeable personnel working on relevant weapon science issues. A successful Stockpile Stewardship and Management Program requires development of facilities and computer tools which will both provide data to mitigate the loss of underground testing and will help retain key technical personnel and attract new people by providing challenging and interesting work. The laboratories are fully integrated into the program. Defense Programs will manage the program.

DOE WEAPONS ACTIVITIES BUDGET

Senator THURMOND. The DOE 5 year budget plan implies an almost 40 percent cut in Weapons Activities in fiscal year 1997. Does DOD plan to support these cuts or does it plan to support the Stockpile Stewardship and Management Plan requirements level of approximately $4.2 billion per year for the next several years?

Will the Secretary of Defense support the one or the other or take no position? When?

Dr. SMITH. The Fiscal Year 1996 Defense Programs (DP) budget submission from the DOE was barely sufficient to conduct a responsible program of stockpile stewardship and management. DOD will strongly oppose any reductions in the DP budget in the near future.

BUDGET CUTS

Senator THURMOND. The DOE 5 year budget plan implies an almost 40 percent cut in Weapons Activities. Do you plan to carry out these cuts or do you plan to adhere to the Stockpile Stewardship and Management Plan requirements level of approximately $4.2 billion/year for the next several years?

Mr. CURTIS. Our preliminary cost analysis suggests, that the Stockpile Stewardship and Management Program would require increased funding after fiscal year 1996. The Department's National Security Five Year Plan, based on the assumptions used in preparing the fiscal year 1996 budget, projects funding requirements for the Stockpile Stewardship and Management Program would rise from $3.6 billion in fiscal year 1996 to about $4 billion by fiscal year 1998. The Department is, however, aggressively pursuing a number of management initiatives to improve program cost efficiency and effectiveness. We are hopeful that the Department's actions will lower the funding required during the 1997–2000 fiscal years while accomplishing the Department's national security mission. We have acknowledged that our preliminary cost projections do not presently match-up with our current OMB outyear budget ceilings. Our fiscal year 1997 budget request and the five year budget plan to be submitted with that request will address this issue more fully as more information on the effectiveness of the initiatives becomes available.

INACTIVE STOCKPILE STATUS

Senator THURMOND. Does DOD intend to maintain START I levels of weapons in the inactive stockpile at a high level or readiness or let all weapons not in the active stockpile (START II levels) deteriorate or be dismantled?

Dr. SMITH. The inactive stockpile serves many purposes. It is not used to allow weapons to deteriorate or as a holding area for the dismantlement process. DOD will require DOE to maintain the requisite resources to reactivate a specific number of inactive stockpile weapons. We will ensure that the warheads are preserved in a state of readiness in accordance with mutually derived reactivation schedules and in a condition to support an upload hedge against a resurgent nuclear threat to the United States.

Mr. CURTIS. The DOE will support the stockpile authorized by the President in the Nuclear Weapons Stockpile Plan. The current Nuclear Weapons Stockpile Plan projects stockpile quantities at START II levels. While the inactive stockpile could be used to maintain higher quantities for potential reconstitution, the DOD has not yet defined requirements for support of the inactive stockpile beyond those previously noted for the Inactive Reserve. The DOE is currently not required to maintain Limited Life Components and tritium for the inactive stockpile. Weapons in the inactive stockpile are evaluated periodically in the Stockpile Surveillance Program to ensure their continued safety. Reliability testing is not currently conducted on the inactive stockpile.

1995 NUCLEAR WEAPONS STOCKPILE MEMORANDUM

Senator THURMOND. When will the 1995 President's Nuclear Weapons Stockpile Memorandum (NWSM) be available in draft for congressional review?

Dr. SMITH. The stockpile has been maintained through changes to the fiscal year 1994 NWSM which will remain in effect until either the fiscal year 1995 or the fiscal year 1996 NWSM is approved by the President.

Senator THURMOND. Will it (the fiscal year 1995 NWSM) explicitly address each NPR recommendation?

Dr. SMITH. Our stockpile plans will ensure the NPR's "lead plus hedge" requirement is maintained. Adequate numbers of weapons will be maintained in the active and inactive stockpiles to ensure a START I force can be uploaded to the maximum extent possible if geopolitical conditions dictate. The proposed NPR START II force and associated weapons will be maintained to ensure our deterrent capability.

Senator THURMOND. Will it (the fiscal year 1995 NWSM) specify the size of the stockpile and the state of its readiness so that DOE will be able to implement its NPR infrastructure recommendation without having to guess at the refabrication and manufacturing requirements of that infrastructure?

When will the President sign it?

Is the existing 1994 NWSM being implemented as policy even though it predates the conclusions of the Nuclear Posture Review?

If so, why?

Dr. SMITH. The next NWSM will specify the size and composition of both the active and inactive stockpiles. The President will sign the NWSM after it has been reviewed by the Secretary of Defense and the Secretary of Energy. The fiscal year

1994 NWSM is the current, Presidentially approved nuclear weapons directive. It remains in force until the President approves the next NWSM.

QUESTIONS SUBMITTED BY SENATOR KAY BAILEY HUTCHISON

MULTI-PURPOSE REACTOR

Senator HUTCHISON. Over a year ago, the Department received a proposal to arrange private financing to build a multi-purpose reactor that would produce tritium, consume excess weapons plutonium, and generate electricity. A privatized effort for these missions would clearly save taxpayers billions of dollars. Why hasn't the Department acted on the proposal yet?

Mr. CURTIS. Acting on a proposal before completing the required environmental impact statement would violate the National Environmental Policy Act. The Tritium Supply and Recycling Programmatic Environmental Impact Statement is expected to be finalized in October 1995, and the Department intends to announce the Record of Decision on a reliable tritium source in November 1995. While a privately-financed multi-purpose reactor is one of the alternatives being assessed in the Tritium Supply and Recycling Programmatic Environmental Impact Statement, it is not clear that such an alternative would save taxpayers billions of dollars when compared to the other alternatives. In fact, one of the primary purposes of the independent cost estimates currently being performed is to determine the cost effectiveness of each alternative being considered.

As for the plan put forward by ABB, it is our view that it is unwise to pursue the "private financing" option for a "multi-purpose" reactor to the exclusion of other potential vendors. Not only is there no justification for a "sole source" arrangement with ABB, but the Department has a number of serious concerns with the ABB proposal.

First, ABB is uncertain about the financial feasibility of their proposal and they requested $50 million over 3 years to conduct a financial feasibility study. This would delay the work on a new tritium source by about 3 years. Second, disposing of 50 metric tons of excess weapons plutonium would require two 1,350-megawatt reactors operating for 30 years while a single 600 megawatt reactor would meet the Nation's need for tritium. Third, ABB is seeking a government guarantee of profitability. Their estimates of the cost to the government range from $78 to $125 million a year. These minimum costs could be significantly higher if they are unable to sell all the electricity at their estimated price. In addition, the entire amount, over 25 years, would have to be scored in the first year's budget. The cost of money to the consortium and the need to make a return on its investment could mean that the life-cycle cost of a privately financed plant to the government is substantially more than one that is government-owned. Fourth, the multiple purpose reactors would generate some 2,700 megawatts to be sold on the power market. This would require an almost unprecedented arrangement, including many contacts and substantially longer commitments (beginning a decade from signing and lasting 25–30 years) than are common in such agreements today.

COST ASSESSMENTS

Senator HUTCHISON. We understand that the Department is waiting for an independent assessment of the cost estimates for the various technologies being considered for tritium production. Based on the information currently available, isn't it obvious that a reactor that generates revenues from electricity sales and disposes of plutonium will be less expensive than an accelerator that consumes electricity while also funding a wholly separate technology program for plutonium disposition?

Mr. CURTIS. The answer is highly dependent on the assumptions that are made regarding: (1) the price of electricity (costs to purchase and revenues from sales), and (2) the alternative ultimately suggested for disposition of excess plutonium. As to the first assumption, the total life cycle costs of an accelerator, which has a relatively low construction cost, are dominated by the purchase price of electricity, while those of the electricity-producing reactors, most of which have relatively high construction costs, are dominated by the amount of electricity that can be produced and the sale price of that electricity. Different assumptions regarding electricity cost/price, each reasonable, can produce significantly different results. That is a primary reason why the Department has initiated an independent cost assessment for the tritium technology alternatives. The least cost option for plutonium disposition has not yet been determined. In addition to cost, technical surety, schedule and nonproliferation will also factor into a final decision.

Senator HUTCHISON. The DOE has suggested that converting weapons grade plutonium into mixed oxide fuel for use in a reactor would somehow undermine or contradict our current policy on reprocessing. However, I understand that the State Department recently sent a communique to the German Government suggesting that they use Russian weapons grade uranium in their reactors to help reduce Russia's plutonium stockpile. Is this true? Have you discussed this matter with your counterpart or anyone else at the Department of State?

Mr. CURTIS. The Department of Energy believes that the once-through use of plutonium recovered from nuclear weapons—provided the material is not reprocessed—is consistent with our current policies on reprocessing and plutonium use. It is not correct, however, to suggest that the State Department has suggested that the German Government use Russia plutonium in their reactors to reduce Russia's nuclear stockpile. The U.S. Government was recently approached by Germany to discuss the topic of their MOX fuel fabrication plants in Hanau which is nearing completion. The State Department has informed German officials that we would be glad to share ideas about the future use of the plant, but no official suggestions or positions have been transmitted.

Senator HUTCHISON. It appears the reactor and accelerator technologies are the two under review for tritium production. Which of these two technologies is the most proven and would require little or no further research and development, and the least time to complete construction? Which is the least proven?

Mr. CURTIS. In addition to the accelerator technology, there are actually three different reactor technologies being considered for a new tritium supply: Heavy Water Reactor (HWR), Modular High Temperature Gas-Cooled Reactor (MHTGR), Advanced Light Water Reactor (LWR). In addition to the technologies being considered for a new facility, the Department is also evaluating the potential use of existing Commercial Light Water Reactors (CLWR). Of these different technologies, the HWR, which would employ the same technology that has been historically used to produce tritium at the Savannah River Site, involves the least technical risk and would require little or no further research and development. None of the other technologies have been used to make tritium in the United States. While all of these technologies could be brought on-line to meet the 2011 need date for new tritium, assuming no potential licensing/safety review delays, the accelerator, which would clearly have the least extensive licensing/safety review requirements, and the CLWR option, have the shortest implementation time. The least proven technology alternative is most likely the MHTGR because it would require significant research and development regarding fuel.

TRITIUM OPTIONS

Senator HUTCHISON. While the Department says that it is keeping an open mind and evaluating all options for tritium production, an internal DOE memorandum dated May 8, 1995 would suggest otherwise. The memo states: ". . . a review has been scheduled for fiscal year 1997 budget requirements associated with tritium technology alternatives" focusing on ". . . contingency target for commercial light water reactors (to be used in a national emergency), and the development of an accelerator for the production of tritium." Why is there no mention of a multi-purpose reactor?

Mr. CURTIS. The internal DOE memorandum referred to was part of the DOE's annual call for budget request, the purpose of which was to develop budget data for all potential outcomes that might result from the Record of Decision on the Tritium Supply and Recycling Programmatic Environmental Impact Statement. Because budget data already existed for the reactor alternatives, that memorandum did not identify a need to develop any additional budget data for the reactor alternatives. That internal memorandum was not meant to represent or imply any preference for tritium supply. A preferred alternative did not exist then, nor is there a preferred alternative today.

COST ESTIMATES

Senator HUTCHISON. It is my understanding that the Department contracted a private firm (the Fluor Daniel Corporation) to determine the cost estimates of each technology under review for tritium production. What was the outcome of that report? Are the rumored estimates of $15 to $20 billion for the accelerator accurate? What were the estimates for the reactor technologies?

Mr. CURTIS. Fluor Daniel is the Architect/Engineering firm that has been supporting the Office of Reconfiguration in developing the technical and cost analyses for the tritium supply technologies. The cost report referred to has not been finalized and is being reviewed as part of the on-going independent cost assessment for tritium supply. While it would be inappropriate and premature to quote any specific figures at this time, based on analysis to date, it can be stated with a high degree of confidence that the cited $15 to $20 billion figure for the accelerator's life cycle costs is too high.

QUESTIONS SUBMITTED BY SENATOR EXON

TRITIUM TECHNOLOGIES

Senator EXON. Secretary Reis, could you briefly assess for the committee your view of the relative strengths and weaknesses of the two competing technologies for the production of tritium?

Mr. REIS. With regard to environment, safety and health considerations, the accelerator option is very attractive compared to the reactor options for several reasons. Unlike the reactors, it uses no fissile material, therefore generating no spent fuel. It produces much less low level and hazardous waste than the reactors, and has no potential for a severe accident having offsite consequences. Therefore, from an environmental, safety and health perspective, the accelerator is relatively "site neutral," whereas there are substantially different impacts (particularly potential accident impacts) for the reactors, depending upon the site selected for evaluation. The accelerator is also easier to decontaminate and decommission at the end of life than a reactor. The environment, safety and health impacts of the accelerator and each of the reactor options are discussed in Chapter 4 of the Draft Tritium Supply and Recycling Programmatic Environmental Impact Statement (PEIS) which has now been published for public review and comment.

There has been much more technical work done on all of the reactor candidates than has been done concerning the Accelerator Production of Tritium (APT) option. The Advanced Light Water Reactors (ALWRs) represent proven technology for commercial electricity production, and improved safety features have been incorporated into the designs compared to the current generation of commercial nuclear power plants. However, light water reactors have never been used for tritium production in this country, and work on the development of a light water target was terminated at congressional direction at the end of fiscal year 1992. Therefore, should this option be selected, the light water target development program would have to be completed and the target qualified should this option be selected. The Department has requested reprogramming authority to finish some of the unfurnished work on these targets.

The Heavy Water Reactor (HWR) analyzed in the Draft PEIS represents an improved version of the technology which has been employed at the Savannah River Site for over 40 years. Therefore, there is a high degree of confidence that such a reactor would make the quantity of tritium required to support the stockpile. However, the HWR is a low-temperature, low-pressure reactor which is not capable of producing electricity as it makes tritium. Furthermore, the heavy water reactor has not benefited from the advanced safety review from the NRC like that being done for the light water reactors. Thus, there is very real risk of delay in developing the HWR for tritium production.

The Modular High Temperature Gas-Cooled Reactor (MHTGR) is a helium-cooled, graphite-moderated reactor which represents the greatest technical risk among all the reactor types. While gas reactors have operated in this country and abroad, none like the one evaluated has ever operated anywhere, and the operating experience with gas reactors in this country has not been good. In addition, there are substantial technical uncertainties regarding the fuel performance for this reactor. Of all of the technology options the MHTGR is the most likely to experience delays, in our judgment. It not only has these technical uncertainties but, like the HWR, does not have the benefit of the advanced safety review from the NRC.

While the MHTGR can generate electricity while making tritium, it is not as efficient in this regard as the ALWRs. Further, while it could burn plutonium and make tritium at the same time, twice as many modules are required to make the goal quantity of tritium using plutonium fuel as would be required to make the same goal quantity using the "normal" high enriched uranium fuel. It should be noted, however, that if this reactor operates as designed, its passive safety features would virtually eliminate concerns about significant offsite health effects as a result of a severe accident.

The APT has been studied over the last several years and preconceptual design completed for a tritium production machine. While accelerator technology has been proven over many decades and the individual components of a tritium producing machine represent demonstrated technology, accelerators have traditionally been operated as research machines in a "pulsed," as opposed to a continuous mode. While there is a high degree of confidence that successful continuous operation in a production mode can demonstrated, that demonstration would be the focus of system integration efforts over the next several years should the accelerator be the selected tritium supply source. The technical confidence in the ability of the accelerator to operate as required comes in large part from the many independent technical reviews that have been done thus far, with the result that no major obstacles have been identified. These reviews have included panels from the Massachusetts Institute of Technology, the JASON group, the Joint Advisory Committee at the Department of Defense and the Lawrence Livermore National Laboratory.

The accelerator concept for tritium production has flexibility such that it can incorporate various sizing and design options to provide advantages in operations and improve tritium production assurance. Thus, the machine can be designed and constructed initially to meet the requirements for a START II stockpile level, with the capability of upgrading the machine quickly to meet potential surge requirements in the event that were necessary.

Unlike the reactors, the accelerator uses a substantial amount of electricity (up to several hundred megawatts) to maintain the beam power and current necessary for the tritium production mission. The most significant portion of annual operating costs for the accelerator are those for purchase of electric power.

While our cost analysis is not yet complete, there are certain conclusions that we can draw. Using existing operating assets to produce the tritium would, of course, be the cheapest. Since the Government has no such operating assets, this would mean commercial reactors, with its attendant policy concerns. Among the options to build a new machine, a small light-water reactor is probably the least expensive based on the early estimates. But the margins of uncertainty are very great and none of the designs analyzed in the PEIS (especially the accelerator) were optimized for the actual tritium production that is needed. They were all "sized" for a comparison of environmental impacts, not a cost comparison.

STOCKPILE STEWARDSHIP PLAN

Senator EXON. Secretary Curtis, what is the state of play on DOE's Stockpile Stewardship plan? Your testimony says you, quote, "have developed" a stockpile stewardship program. Is that correct? With what other agencies has the Stewardship plan been shared?

Mr. CURTIS. Attached is a copy of Defense Programs' "Stockpile Stewardship and Management Program". To date, DOE has provided this document to the Office of Management and Budget, the Department of Defense and the National Security Council. The document was published in mid-May, and is available to the public at the Defense Programs Home Page on the Internet/World Wide Web (http://www.dp.doe.gov/).

May 1995

The Stockpile Stewardship and Management Program

Maintaining Confidence in the Safety and Reliability of the Enduring U.S. Nuclear Weapon Stockpile

U.S. Department of Energy
Office of Defense Programs

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Preface

RECENT changes in national security needs have necessitated corresponding changes in the way the Department of Energy must meet its responsibilities regarding U.S. nuclear weapons. As a result of the START I treaty, the START II agreement, and the recently completed Nuclear Posture Review, the nation's stockpile is being greatly reduced. The Nuclear Posture Review forecasts steady declines in both the size and diversity of the U.S. nuclear stockpile through the year 2003, at which time the strategic accountable warhead base is projected to be 3000 to 3500 weapons of some seven weapon types. The Department will maintain the capability to reconstitute or reduce this force further. The U.S. has halted the development of new nuclear weapons and has begun closing portions of the weapon production complex and consolidating the remaining elements. In addition, the nation is observing a moratorium on nuclear testing and is pursuing a comprehensive test ban.

However, nuclear dangers remain, and the continued maintenance of a safe and reliable U.S. nuclear deterent is a cornerstone of U.S. national security policy. Thus, the Department of Energy's responsibilities for ensuring the safety, security, and reliability of the U.S. nuclear weapon stockpile will also continue for the foreseeable future.

Meeting these stockpile stewardship and management responsibilities will be more challenging now than ever before, given the moratorium on nuclear testing, the termination of new weapons development, and the closure of production facilities. A new approach to ensuring confidence in the U.S. stockpile is needed. This new approach must rely on scientific understanding and expert judgment, not on nuclear testing and the development of new weapons, to predict, identify, and correct problems affecting the safety and reliability of the stockpile.

Meeting this challenge will be neither inexpensive nor without risk. However, if the strategies laid out by the Stockpile Stewardship and Management Program are followed, both in the near term and the long term, we have confidence that we will be able to successfully meet this new challenge.

In this report, we outline the Department of Energy's Stockpile Stewardship and Management Program. We summarize the technical issues that must be addressed and the enhanced capabilities and facilities that are needed. The program strategy includes the preparation of a Programmatic Environmental Impact Statement under the National Environmental Policy Act to address the environmental impacts associated with the proposed program and a range of reasonable alternatives. In the judgement of the Department, the Stockpile Stewardship and Management Program is essential if the nation is to properly safeguard its nuclear weapons and maintain an unquestioned nuclear deterrent.

In announcing the extension of the nuclear testing moratorium (July 1993), President Clinton reaffirmed the importance of maintaining confidence in the enduring U.S. nuclear stockpile and the imperative to assure that the nation's nuclear deterrent remains unquestioned during a test ban. He clearly acknowledged the need to explore other ways of maintaining confidence in the safety, reliability, and performance of U.S. nuclear weapons. By Presidential Decision Directive and act of Congress (P.L. 103–160), the Department of Energy was directed to "establish a stewardship program to ensure the preservation of the core intellectual and technical competencies of the U.S. in nuclear weapons."

We have developed the Stockpile Stewardship and Management Program to meet the challenges involved in ensuring the safety, reliability, and performance of the enduring stockpile. This program charts a course that must be stayed over the long term to provide responsible and effective stewardship and management of the nation's nuclear deterrent.

Three particular challenges must be met:

- Fully supporting, at all times, the U.S. nuclear deterrent with safe, secure, reliable nuclear weapons while transforming the nuclear weapon complex (laboratories and production facilities) to one that is more appropriate for the smaller enduring stockpile.
- Preserving the core intellectual and technical competencies of the weapons laboratories. Without nuclear testing, confidence in the U.S. nuclear deterrent will rest with confidence in the competency of the people who must make the scientific and technical judgments related to the safety and reliability of U.S. nuclear weapons. A "science-based" stockpile stewardship and management program will enable those people responsible for maintaining the U.S. nuclear stockpile to increase their fundamental understanding of the basic scientific phenomena associated with nuclear weapons.
- Ensuring that the activities needed to maintain the nation's nuclear deterrent are coordinated and compatible with the nation's arms-control and nonproliferation objectives.

Our preliminary cost analysis suggests that, in the absence of a series of ongoing and planned program and management improvements in the way the Department of Energy operates, the Stockpile Stewardship and Management Program would require increased funding after fiscal year 1996. The Department's National Security Five-Year Budget Plan, based on the assumptions used in preparing the fiscal year 1996 budget, projected that without reinvention, funding requirements for the Stockpile Stewardship and Management Program would rise from $3.6 billion in fiscal year 1996 to about $4 billion by fiscal year 1998. The Department is, however, aggressively changing the way it does business. It is anticipated that the Department's initiatives will lower the funding required during the 1997–2000 fiscal years while accomplishing the Department's national security mission.

The Stockpile Stewardship and Management Program is a single, highly integrated technical program for maintaining the safety and reliability of the U.S. nuclear stockpile in an era without nuclear testing and without new weapons development and production. Traditionally, the activities of the three weapons laboratories and the nuclear test site in Nevada have been regarded separately, and funded separately, from the activities of the weapon production complex. However, all stockpile stewardship and management activities are closely linked to each other, and all are essential to ensure continued confidence in the nation's nuclear deterrent.

Recently, the Department received recommendations from the Galvin Task Force, which provided a comprehensive review of the Department of Energy laboratory system. The Department is committed to carrying out the majority of the Task Force's recommendations and expects that the implementation of these recommendations will result in a laboratory system that is more efficient, cost-effective, and mission-focused. On the question of the Lawrence Livermore National Laboratory, the Department is carefully reviewing the recommended phase-down of Livermore's work in nuclear weapon design and engineering. The timing and details of such a phase-down must depend wholly on how we can best meet our continuing national security responsibilities, as discussed in this report.

Past Approach to Maintaining Stockpile Confidence

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The U.S. nuclear weapon stockpile is currently judged to be safe, secure, and reliable. However, decades of experience with the stockpile has often revealed the need for repair or replacement of components and subsystems. Of the weapon systems introduced into the stockpile since 1970, nearly half have required post-development nuclear testing to verify, resolve, or fix problems relating to safety or reliability. Of the seven weapon systems that are candidates for the enduring (START II) stockpile, all seven have already been retrofitted to some degree, including the replacement of major nuclear components in some cases.

The average age of the stockpile has never significantly exceeded the current average age of 12 to 13 years. Although we cannot predict with certainty when age-related changes affecting weapon safety or reliability will occur, we must anticipate they will arise more frequently as the weapons retained in the enduring stockpile age to and beyond their original 20- to 25-year design lifetimes (Figure 1).

In the past, a large, often renewed, and diverse stockpile provided "insurance" against single-point and common-mode failures (i.e., failures or defects compromising the safety or reliability of, respectively, a single weapon system or several systems sharing a common design feature). Nuclear testing could be done to provide unambiguous verification of the effects of design features, material changes, or safety issues that could not be adequately calculated or tested in other ways. Continuous development and production of new weapon systems not only provided the U.S. stockpile with the most modern and effective weapons but also maintained the technical competence of the laboratory and production complex in the science and engineering of nuclear weapons. In addition, a steady supply of tritium was provided to support new weapons and to replenish the inventory reduction caused by radioactive decay of the tritium in existing weapons.

Today, none of these conditions exist. Thus it is essential that we develop new strategies and approaches to ensure the safety, reliability, and performance of the stockpile (and confidence in our ability to do so) under current conditions—namely, no nuclear testing and no new weapons in development or production. In addition, we must provide a source of tritium.

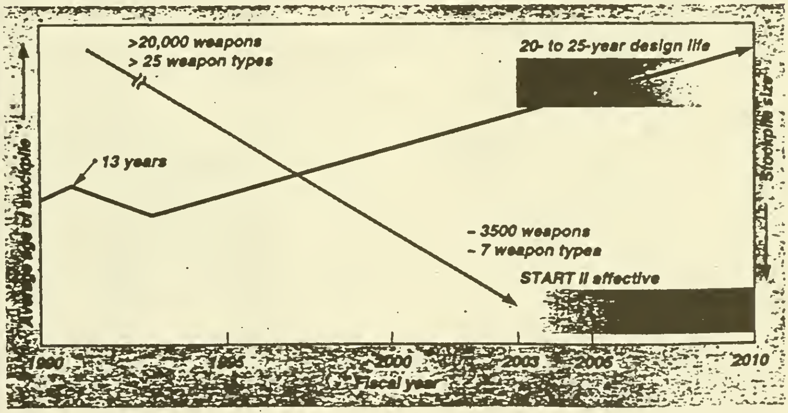


Figure 1. Projection of the size and average age of the U.S. nuclear stockpile to the year 2010, assuming current dismantlement plans and current thinking on the composition of the post-START II stockpile. These projections also assume no introduction of new production units and do not account for weapon lifetime extensions.

Program Goals

THE primary goal of the Stockpile Stewardship and Management Program is to provide:

- High confidence in the safety, security, and reliability of the U.S. stockpile to ensure the effectiveness of the U.S. nuclear deterrent while simultaneously supporting U.S. arms-control and nonproliferation policy.

Because the stockpile must endure, the program must provide:

- A small, affordable, and effective production complex to provide component and weapon replacements when needed, including limited-lifetime components and tritium.

Because the world is uncertain and global nuclear threats persist, the program must provide:

- The ability to reconstitute U.S. nuclear testing and weapon production capacities (consistent with Presidential directives and the Nuclear Posture Review), should national security so demand in the future.

Nuclear Test Readiness

The capability to resume underground nuclear testing will be preserved in accordance with the direction of the President. We will document past test data, interview laboratory people with nuclear testing experience, and archive this information for the future. With a steady program of sophisticated related nonnuclear experiments, we expect to be able to retain and refresh the knowledge and skills needed for nuclear testing.

Critical Scientific and Technical Issues

IN developing the Stockpile Stewardship and Management Program, we assessed the scientific and technical issues required to ensure the safety and reliability of the enduring U.S. stockpile. The enduring stockpile was assumed to be the START II stockpile projected by the Nuclear Posture Review. We "stepped forward" to the needs of the stockpile in 2010, when almost all of the candidate weapon systems for the START II stockpile will have reached or exceeded their original design life. Our goal was to identify strategies that would enable us to maintain these weapons continuously, preserve the program-essential technical competence of the weapons laboratories, and transform the existing laboratory and production complex into a smaller, more efficient, less costly complex appropriate for supporting the smaller, less diverse stockpile of the future. The overall program strategy was driven by Department of Defense requirements of the Department of Energy (as identified by the Nuclear Posture Review) to:

- Maintain U.S. nuclear weapons capabilities without nuclear testing or the production of fissile materials and without the production of new-design warheads.
- Ensure the availability of tritium.

Five critical issues were identified, and strategies were developed to address them.

Maintaining Confidence in Stockpile Safety and Reliability without Nuclear Testing

- Nuclear testing provided data sufficient to assess and maintain confidence in the safety and performance of the stockpile weapons.
- Upgraded or new experimental and computational capabilities are needed to fill in those areas of nuclear weapon science that are incomplete, especially gaps in our physics understanding and holes in the data needed for computational simulations of weapon performance and assessments of weapon safety and reliability.
- An improved science-based program with enhanced experimental and computational capabilities is necessary to prevent loss of confidence in the stockpile. This program must be technically challenging so that it will attract the high-quality scientific and technical talent needed for future stewardship of the stockpile.
- The strategy to address this critical issue is discussed under "Enhanced Experimental and Computational Capabilities" (p. 5).

Reducing the Vulnerability of the Smaller Stockpile to Single-Point and Common-Mode Failures

- A large stockpile, with over 20,000 weapons and more than 25 weapon systems, provided substantial protection against single-point and common-mode failures.
- A smaller stockpile, with fewer than 5000 weapons and 7 weapon systems, will be far more vulnerable to single-point and common-mode failures.
- Enhanced weapon and materials surveillance capabilities are necessary to detect potential problems earlier and lessen the vulnerability of the enduring stockpile to these failures.
- The strategy to address this critical issue is discussed under "Enhanced Weapon and Materials Surveillance Technologies" (p. 6).

Providing an Effective and Efficient Production Complex for the Smaller Stockpile

- In the past, a large weapon production complex of seven plant sites provided the capability and capacity to rapidly fix problems in the stockpile.
- Currently, only four plant sites are available (Kansas City, Pantex, Savannah River, and Oak Ridge). Nonnuclear functions are being consolidated and reestablished, and some nuclear functions are not currently available and will be difficult to reestablish. The existing production complex would be inefficient and ineffective for the smaller enduring stockpile.
- Advanced manufacturing and materials technologies must be developed to provide timely and flexible response in correcting stockpile problems. Research, development, and manufacturing must be highly integrated. The capacity-based production infrastructure of the past, which relied heavily on a production complex geared to continuous upgrading and renewal of a relatively large stockpile, must be replaced by a much smaller and more efficient capability-based complex supported by improved scientific understanding of nuclear weapons and their production processes.
- The strategy to address this critical issue is discussed under "Effective and Efficient Production Complex" (p. 7).

Providing for Long-Range Support of the Enduring Stockpile

- In the past, continuous development and production of new weapons maintained the scientific and technical knowledge and skills base essential for maintaining the safety and reliability of the stockpile.
- With no new weapons in development or production, budget reductions, and an aging staff with actual experience in designing, testing, and producing nuclear weapons, the knowledge and skills base unique to nuclear weapons will atrophy.
- A new, long-range planning strategy needs to be developed in conjunction with the Department of Defense. This strategy must allow for a weapons complex (design, development, and production) to maintain the U.S. nuclear stockpile and support the nation's nuclear deterrent in the future while meeting our obligation to maintain the safety and reliability of the stockpile while transitioning to a complex more appropriately sized and structured to ensure efficiency and effectiveness in supporting the nation's nuclear deterrent in the future. This long-range strategy should protect the national security option to develop new nuclear weapons.
- The strategy to address this critical issue is discussed under "Long-Range Stockpile Support" (p. 9).

Ensuring an Adequate Supply of Tritium

- All of the candidate weapons for the START II stockpile require tritium replenishment.
- No production source of new tritium currently exists.
- Although the projected START II stockpile and the mandated five-year reserve can be maintained until about 2011 by recycling existing tritium supplies, it will likely take 10 to 15 years to bring a new tritium production source on line. Reactor and accelerator technologies for producing tritium are currently being evaluated, and a decision as to the preferred approach is expected later this year.
- The Department is also developing a contingency option for the production of tritium in the event of a national emergency.
- The strategy to address this critical issue is discussed under "Tritium Production" (p. 10).

THE following strategies have been defined to address the critical issues related to ensuring the safety, reliability, and performance of the enduring U.S. nuclear stockpile.

Confidence without Nuclear Testing

- *Underground nuclear testing provided data sufficient to assess and maintain confidence in the safety and performance of the U.S. stockpile.*
- *Enhanced predictive capabilities are needed to assess complex problems affecting an aging stockpile.*
- *Our fundamental understanding of the physics of nuclear weapons must be improved.*

Enhanced Computational Capabilities

- *Accelerated Strategic Computing Initiative (ASCI):*
  - *Increases of more than 1000-fold in computational speed and data storage.*
  - *Full-system, high-fidelity predictive capability.*

Enhanced Experimental Capabilities

- *Dynamic radiography:*
  - *Multiple views at multiple times.*
  - *Higher resolution.*
- *Lasers and pulsed power:*
  - *Higher energy and power density.*
  - *Broad range of pulse widths.*

Enhanced Experimental and Computational Capabilities

Substantial advances in experimental and computational capabilities are needed to maintain confidence in the safety and performance of the U.S. stockpile without nuclear testing. Without nuclear testing as the final "arbiter," we must fill in those areas of nuclear weapon science that are incomplete, particularly gaps in our physics understanding and holes in the data needed for computational simulations of weapon performance and model-based assessments of safety and reliability issues. Upgraded or new experimental capabilities are needed to meet these requirements and, at the same time, to validate improved or new computational models.

Enhanced capabilities will provide the ability to evaluate some safety and performance issues that could have significant stockpile consequences. (It is possible that without enhanced capabilities, some nuclear components exhibiting changes in composition or structure might have to be retired because we would not be able to certify the acceptability of repaired or modified components.) Furthermore, enhanced experimental and computational capabilities, will enable us to maintain the knowledge and skill base that is essential for training new weapons program personnel. The Appendix (p. 14) provides a description of the proposed new facilities and new facilities under consideration to support the Department of Energy's science-based Stockpile Stewardship and Management Program.

Aboveground Experimental Capabilities

Several aboveground experimental capabilities have been identified that can compensate, at least partially, for the absence of nuclear testing in assessing the performance and safety of nuclear assemblies.

Primaries. Technical issues of particular concern regarding the primary stage of a nuclear weapon include nuclear criticality of the assembly, ignition of the deuterium-tritium boost gas, the three-dimensional shape of the late-time boost-gas cavity, and the effect of the mix of materials into the boost gas on burn and ignition. High-resolution, multiple-time, multiple-view hydrodynamic experiments using simulant materials will be used to define the implosion characteristics and assess primary safety, reliability, and performance. Well-diagnosed pulsed-power and laser-based experiments will also be used to gain an improved understanding of implosion and ignition physics. Pulsed-power and laser facilities could also be used for studies of the effects of materials behavior, including age-related material changes, on primary performance. The data gathered in such experiments will be essential for evaluating new and evolving computational models of primary-stage behavior.

Vulnerability of a Smaller, Less-Diverse Stockpile

- *More than 20,000 to fewer than 5000 weapons.*
- *More than 25 to fewer than 7 weapon types.*
- *All weapons will age beyond their original design life.*

Enhanced Surveillance Capabilities

- *Nondestructive technology to examine weapon components.*
- *Sensors built into stockpile weapons to monitor status.*
- *Predictive models based on materials science.*

Secondaries. Critical issues for weapon secondary relate to the effects on system performance of manufacturing imperfections and age-related changes in materials characteristics. In order to assess the effects of these manufacturing and materials features, we require improved predictive capabilities regarding radiation transport, secondary hydrodynamics, and fusion burn. More complete and more accurate experimental data are needed to improve our understanding of weapon physics issues related to secondary safety and performance. However, the conditions relevant to secondary performance are extremely difficult to create in a laboratory setting, and most data must be extrapolated to the weapons regime, which requires the expert judgment of weapons scientists. Some of the facilities needed to address issues related to primary stages could also be used to investigate secondary-stage issues, but other facilities specific to secondaries are also needed.

Computational Capabilities

To ensure the safety and reliability of the enduring stockpile, computational simulation must fill the void, to the extent possible, left by the termination of nuclear testing. Computational capabilities underpin every aspect of nuclear weapon design, engineering, and evaluation. Because many aspects of nuclear weapons are extremely complex, a fine balance has existed between physical experiments and numerical simulation. Without nuclear testing, numerical simulations will be the principal way of evaluating the safety of nuclear assemblies and the only way of estimating full system performance. Numerical simulations will also provide an essential tie to the data from past nuclear tests, which is an essential element of ensuring the safety and performance of the enduring stockpile without underground nuclear testing. Computational simulation will be an essential (and sometimes the only) means of predicting the effects of materials aging on component and weapon performance.

Increases of more than a thousand-fold in computational speed and data storage are needed to handle simulations of weapon performance and assessments of weapon safety of the required complexity and detail. Improvements are needed in the spatial resolution (fineness of detail) of the simulation and in the number of dimensions that can be modeled (three dimensions, not just one or two). We must also increase the completeness of our physics models, incorporating improved and extended physics data and more complete physics understanding. This effort is closely linked to experimental efforts to provide improved and expanded physics data and to test the predictions of new or evolving computer models.

The goal of the recently established Accelerated Strategic Computing Initiative (ASCI) is to meet these computational requirements. The weapons laboratories will collaborate with industry and other government agencies to reduce the cost of developing these enhanced capabilities. Clearly, the advances required in computational capability and many of the experimental initiatives required for stockpile stewardship and management are interdependent.

Enhanced Weapon and Materials Surveillance Technologies

Because it will be smaller and less diverse, the enduring U.S. stockpile will be more vulnerable to single-point and common-mode failures (i.e., failures or defects compromising the safety or reliability of, respectively, a single weapon system or several systems sharing a common design feature). New surveillance technologies, coupled with enhanced predictive capabilities as to the effects of materials aging on component and weapon performance, are needed so that we can detect potential safety or reliability problems long before they become serious. New technologies and devices are needed for assessing the "health" of stockpile weapons. Without such improvements in our surveillance capabilities, the possibility of a common-mode failure nullifying a large fraction of the enduring stockpile will become a major concern.

Materials Science and Technology

We must develop a better understanding of how aging affects a material's physical characteristics. Innovative experimentation will be coupled with enhanced computational capabilities to create predictive models of the effect of age-related materials changes on system performance. Upgraded materials science laboratories will be needed, especially for plutonium and other nuclear materials (e.g., the Chemistry and Metallurgy Research Laboratory at Los Alamos).

Nondestructive Evaluation

Improved nondestructive evaluation techniques, such as acoustic, x-ray, and neutron tomography, would allow us to reduce the number of nuclear components that must be destructively tested to certify their safety and reliability. Of particular importance is the ability to nondestructively examine nuclear assemblies. Facilities such as the Los Alamos Neutron Scattering Center (LANSCE) are able to use high-energy neutron radiography to image low-density materials inside high-density metals and thus may be suitable for surveillance of stockpile nuclear assemblies.

Sensors

Integrated sensor packages could provide self-diagnostics of weapon components and subsystems, greatly enhancing the effectiveness of stockpile surveillance. The Stockpile Stewardship and Management Program calls for activities to develop sensors that can identify unique signatures (e.g., chemical) that correlate to materials aging concerns. Materials science and microelectronics development laboratories will be essential for the development of such weapon self-diagnostic capabilities.

Hydro Experiments

Hydrodynamic testing on test units built, when possible, with aged stockpile components (with modified pits using simulant materials) will provide important data on the effects of aging on weapon safety and performance. Data from experiments with these test units will augment the baseline data from hydrodynamic tests of stockpile weapons.

Large Production Complex Ineffective for Smaller Stockpile

- *Facility infrastructure costs are high, especially those for nuclear facilities.*
- *Some production capabilities and capacities have already been lost.*
- *Older manufacturing processes do not meet modern environmental, safety, and health standards.*

Hydronuclear experiments were conducted during the 1958–1961 test moratorium to address stockpile safety concerns. These experiments combined the normal high-explosive trigger for a nuclear device with a quantity of fissile material much less than that required for a nuclear explosion, as the term is usually understood. The Department of Energy currently has no plans to conduct hydronuclear experiments in the 1995 and 1996 fiscal years.

Effective and Efficient Production Complex

In years past, a large weapon production complex provided the capability and capacity to rapidly fix problems with stockpile weapons. Today, elements of the production complex have already been shut down and manufacturing capabilities are being consolidated at fewer sites, which are being downsized as well. At the end of the 1994 fiscal year, the Rocky Flats, Mound, and Pinellas plants completed their last deliveries of products to the stockpile. Production capabilities formerly located at these sites have been or are being established at other sites. However, it will not be practical or cost effective to meet future manufacturing needs by keeping many of the old processes or facilities on "standby."

New Approach to Manufacturing

Clearly, a different approach is needed. Investment will be needed to develop manufacturing processes that are agile, safe, and minimize the production of hazardous waste. Most important, attempting to maintain current production capability and infrastructure is not feasible under today's conditions (i.e., no new weapons development or production, the closure

Manufacturing and Materials Technology

- Integrate research and development with manufacturing activities.
- Capability-based production capacity.
- Low-cost, rapid, and flexible response to fix stockpile problems.

Remanufacturing

At first glance, remanufacturing of weapon components to their original specifications appears to be a straightforward, low-cost approach to maintaining the stockpile. One could reason that since the designs for the weapons are available, it should be a matter-of-fact process to simply build identical units to replace aging stockpile weapons. However, upon closer examination, this approach is seen to have many drawbacks. Precise replication would not always be possible because deviations from original specifications would occur as a result of interrupted commercial supply bases for specific materials and products. Changes in commercial technology, such as electronics, are frequent, and previously available parts and devices are discontinued. Materials and manufacturing processes are modified to meet more stringent environment, safety, and health standards. In addition, remanufacturing alone would not permit stockpile improvements to address reliability or safety concerns. Perhaps most important, remanufacturing would not retain the required breadth and depth of nuclear weapon expertise and judgment that will be needed to address future concerns about the safety and reliability of an aging stockpile. Therefore, we conclude that remanufacturing alone is not sufficient to maintain and manage the enduring U.S. stockpile.

and downsizing of existing production facilities, increasingly stringent regulations regarding hazardous waste). In order to ensure the safety and reliability of the enduring U.S. stockpile, appropriate new manufacturing capabilities must be developed that eliminate the need for large facilities and infrastructure.

The Stockpile Stewardship and Management Program calls for concurrent engineering—namely, the integrated development of weapon components with the associated advanced manufacturing and materials processes. This integrated approach to design and manufacturing will provide the capability to respond flexibly and rapidly to potential needs for production. It will also be much more cost effective than the sequential approach used in the past. Further cost savings can be realized by using commercially available products and processes wherever appropriate.

Computer-based models to predict the performance of weapon components and to describe the associated manufacturing processes are a key element of concurrent engineering. Models of the manufacturing processes will make it possible to identify process-control signatures, and the models can be used on the factory floor to implement sensor-based adaptive process control during manufacture. Detailed process descriptions, especially when combined with process-control instrumentation, will make it possible to produce the small quantities of reliable, high-quality, specialty products needed to maintain the enduring U.S. stockpile. The advanced computational capabilities developed through the ASCI initiative will help realize the full potential of model-based weapon design and manufacturing.

The Department of Energy has established the ADAPT (Advanced Design and Production Technologies) initiative to develop the tools needed to realize these objectives.

System Engineering

System engineering—the myriad tasks involved in turning a nuclear assembly into a deployable weapon—is closely linked with production capabilities and therefore must be integrated with this new approach to manufacturing and materials. In the past, weapon system and subsystem engineering relied on prototype testing, with sequential steps of design, testing, and evaluation, followed by design modification, further testing, and further evaluation. For the future, system engineering will rely more extensively on computer modeling to predict system, subsystem, and component performance before any hardware is produced. Computer-based models will also be used extensively to evaluate the safety and reliability of weapon systems when exposed to a wide range of abnormal environments, such as severe accidents. The number of costly prototypes that must be fabricated and tested will be greatly reduced, making this computer-based approach to system engineering more cost effective. In addition, integrating model-based development of manufacturing processes into the early stages of engineering ensures the producibility of the component or system and makes it possible to use cost as a factor for selecting among alternative designs. Effective implementation of this approach requires increases in computational speed and memory and thus is dependent on the ASCI initiative.

A number of unique test facilities must be retained and selectively enhanced, including environmental test facilities for evaluating model predictions, certifying performance, and assessing safety. Test ranges for conducting joint flight tests with the military to evaluate weapon system performance under realistic weapon delivery conditions will still be required. Enhanced experimental capabilities may also be needed to evaluate weapons and components in combined environments (e.g., heat plus shock) or to certify the hardness of replacement components to neutrons, gamma rays, and x rays.

Long-Range Stockpile Support

As long as the U.S. has a nuclear weapon stockpile, there will be a need to evaluate periodically the safety, security, and reliability of each of the weapon types in the stockpile, to repair them when concerns arise, to upgrade them to meet more demanding safety and security standards and new military requirements, to replace them when refurbishment is not practical or cost effective, and to dismantle them at the end of their useful lifetime. Many of the capabilities needed for long-term support of the stockpile currently exist and will be maintained. However, as a result of the closure of elements of the production complex, some capabilities need to be reestablished and others need to be enhanced.

Dismantlement

Sufficient stockpile dismantlement capabilities currently exist. From fiscal year 1991 to the present, the Department of Energy has dismantled more than 7000 nuclear weapons. The capability—specifically the technical expertise and unique facilities currently located at the Pantex Plant and the design expertise and judgment only available at the weapons laboratories—must be sustained to meet future dismantlement requirements.

Advanced Production Technology

- *Computer-generated solid models of products.*
- *Electronic information about material properties.*
- *Predictive computer models of manufacturing processes.*
- *Sensor-based adaptive process control of manufacturing.*

Long-Range Stockpile Support

- *In the past, continuous design, development, and production of nuclear weapons "stabilized" the laboratory and production complex.*
- *Without a steady flow of new weapon development projects, a different approach to long-range stockpile support is needed.*

Routine Stockpile Surveillance

Routine stockpile surveillance activities will continue. Each year, a statistically significant fraction of every weapon type in the active stockpile will be evaluated and tested. We will use laboratory tests, which evaluate conditions and performance of individual components against design requirements, as well as flight tests of modified warheads (in which fissile materials are replaced with simulant materials), which verify nonnuclear performance in a delivery environment. Currently, more than a hundred weapons are removed annually from the stockpile for laboratory and flight tests. For the aging, less-diverse enduring stockpile, new evaluation techniques must be developed to identify and deal with common-mode failures that could negate a significant fraction of the stockpile.

Corrective Maintenance and System Replacement

In the past, safety and reliability concerns could be addressed by replacing older weapon systems with new ones incorporating modern safety, security, and performance features. Since there are no new weapons in development or production, this approach is no longer possible.

**Example of Preventive Maintenance—
Neutron Generator**

- **Repair:**
  - **Correct detonator corrosion problem.**
- **Life extension:**
  - **Review tube life data annually.**
- **Replacement:**
  - **Develop new generator with improved reliability and durability (in progress).**

Instead, we will retrofit, upgrade, or replace stockpile weapons to ensure their continued safety, security, and reliability. Indeed, one of the weapon systems slated for the enduring stockpile is currently being retrofitted at Pantex with safety, security, and reliability upgrades, and several other field and Pantex retrofits are planned for the next five years.

The Stockpile Stewardship and Management Program calls for new approaches to ensuring the ability to fix problems that will undoubtedly occur in the aging stockpile. To start with, safety margins will be increased (which may include modifications to primaries), use-control technology will be enhanced, and components produced with "sunset" technologies (i.e., products and processes that become obsolete because of, for example, increasingly stringent environmental or safety regulations) will be replaced. To accomplish these objectives cost effectively, we will conduct planned product-improvement programs that will significantly advance the safety, security, reliability, and/or maintainability of stockpile weapons. To extend the lifetime of weapon components without jeopardizing safety or reliability, we will use improved predictive capabilities, made possible by a combination of computational modeling and experimentation, to define age-related changes in materials properties and will engage in preventative maintenance (before a problem develops) of the stockpile. This approach has already been used successfully for such limited-lifetime components (LLCs) as neutron generators and tritium reservoirs, and it may be possible to extend this approach to entire weapon systems. Not only will these activities ensure and improve the safety and reliability of the enduring stockpile, but they will also exercise and sustain much of the skill base required for nuclear weapon development and production and thus help maintain the nation's nuclear competency.

Improvements to the stockpile must be made through a strategy that does not call for significant new weapons production or complete rebuilding of the candidate weapons for the START II stockpile. It is not cost effective, and perhaps not even feasible, to simply replace individual weapons when they reach the end of their original design lifetime (20 to 25 years, depending on weapon type). A new strategy will be developed in conjunction with the Department of Defense. It will rely extensively on preplanned lifetime extension projects and, whenever a major retrofit is not cost effective, on one-for-one complete system replacements. The retrofit/rebuild schedules will be phased to level the production and recertification workload and to ensure sustainable effectiveness of design, engineering, and production capabilities in every critical area.

Tritium Production

Tritium is required for all weapons in the enduring U.S. stockpile. This radioactive isotope of hydrogen has a half-life of 12.5 years and decays at the rate of about 5% per year. Tritium has not been produced in the U.S. since 1988. Stockpile tritium requirements are currently being met by recycling the tritium from dismantled weapons. Recycling will meet the tritium requirements of all of the weapons in the START II stockpile, including a five-year reserve, until about 2011. Clearly, some means of tritium production will be required to support the stockpile after that time.

Various tritium production technologies are being evaluated by the Department of Energy, and the preferred technology will be selected in the near future. The following technologies for producing tritium are being considered: accelerator, advanced light-water reactor, heavy-water reactor, and modular high-temperature gas-cooled reactor. Candidate sites for tritium production and recycling are the Idaho National Engineering Laboratory, the Nevada Test Site, the Oak Ridge site (Tennessee), the Pantex Plant (Texas), and the Savannah River Plant (South Carolina). It is estimated that, regardless of the technology and site chosen, it will take 10 to 15 years to establish a new tritium production capability. The current plan provides for a technically proven contingency supply of tritium, based on a commercial light-water reactor, to respond in the event of a national emergency.

The tritium recycle and supply proposal has its own programmatic environmental impact statement. A record of decision on the technology and siting is scheduled for this year.

BUDGET projections derived from a preliminary analysis of the Stockpile Stewardship and Management Program are shown in Figure 2. The rise in funding for the next several years is the investment that would be required to implement this science-based Stockpile Stewardship and Management Program in the absence of the Department's reinvention efforts to improve efficiency and reduce costs.

Stockpile stewardship costs include all research and development activities at the weapons laboratories to implement the program strategies and maintain the Presidentially directed test-readiness posture at the Nevada Test Site. The stockpile stewardship cost estimate includes the proposed new experimental test facilities (the Dual Axis Radiographic Hydrodynamic Test Facility, the Contained Firing Facility, the Atlas Facility, the National Ignition Facility, and the Process and Environmental Technology Laboratory; see the Appendix, p. 14, for descriptions of these facilities). Stockpile management costs include a new tritium production facility and the activities associated with dismantling the nonenduring stockpile, with maintenance and surveillance of the enduring stockpile, and with the implementation of new manufacturing and surveillance technologies to support the enduring stockpile.

These budget projections do not include the following: worker retraining, science education support at public schools, or national economic competitiveness not critical to nuclear weapons. Neither do they include the cost of decommissioning and decontaminating facilities, direct funding for nonproliferation and arms control activities, or the cost of storage and disposition of excess nuclear components and materials after fiscal year 1997.

Our preliminary cost analysis suggests that, in the absence of a series of ongoing and planned program and management improvements in the way the Department of Energy operates, the Stockpile Stewardship and Management Program would require increased funding after fiscal year 1996. The Department's National Security Five-Year Budget Plan, based on the assumptions used in preparing the fiscal year 1996 budget, projected that without reinvention, funding requirements for the Stockpile Stewardship and Management Program would rise from $3.6 billion in the 1996 fiscal year to about $4 billion by fiscal year 1998. The Department is, however, aggressively changing the way it does business. It is anticipated that the Department's initiatives will lower the funding required during the 1997–2000 fiscal years while accomplishing the Department's national security mission.

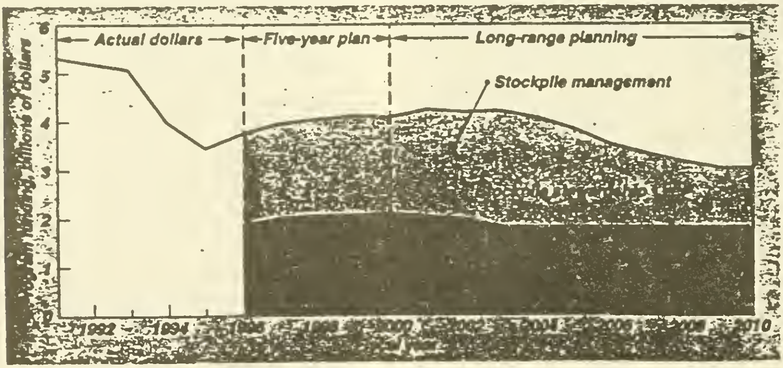


Figure 2. Budget projection for the Stockpile Stewardship and Management Program in budget-year dollars for the fiscal years 1991 through 2000 before reinvention (costs for 2001 and beyond are in constant fiscal year 1996 dollars). It is anticipated that the Department's initiatives will reduce the funding required for fiscal year 1997 and beyond. Costs for the various elements of the program are cumulative.

Programmatic Environmental Impact Statement

The Department of Energy has committed to do a programmatic environmental impact statement (PEIS) for the Stockpile Stewardship and Management Program. To assist in the development of this PEIS, the Department plans to hold an information meeting in the Washington, D.C., area prior to the "notice of intent" and to involve stakeholders through formal scoping meetings in the vicinity of the three weapons laboratories, the four remaining production plant locations, and the Nevada Test Site. A tentative schedule for the PEIS follows.

Period	Milestone
May 1995	Information meeting
June 1995	Notice of intent
June–August 1995	Scoping meetings
September–October 1995	Implementation plan
January–February 1996	Draft PEIS
July–August 1996	Final PEIS

Summary: Maintaining Confidence in the Safety and Reliability of the Enduring U.S. Nuclear Weapon Stockpile

We must take positive steps to preserve the current high confidence in the safety and (to the extent possible without nuclear testing) the performance of the enduring stockpile. This raises the questions of how one measures confidence and what level of confidence is desired. Confidence is subjective and, as such, rests on the judgment of people. Judgment is based on information, experience, and trust in the sources of the information and experience. This link between

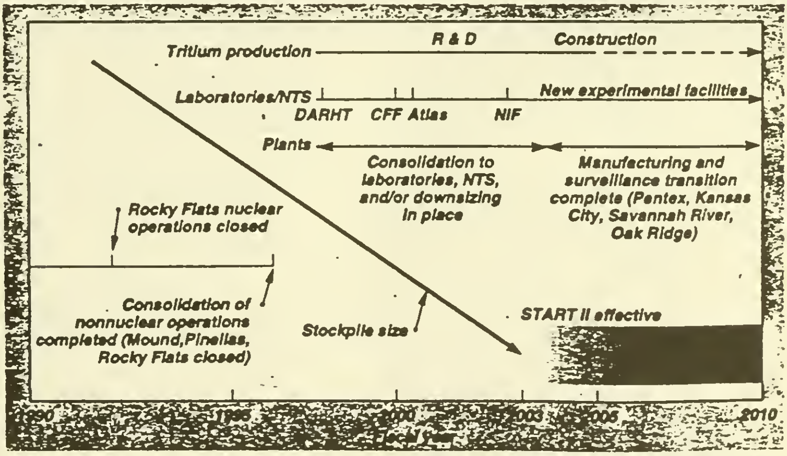

Tritium production
R & D
Construction
Laboratories/NTS
New experimental facilities
DARHT
CFF
Atlas
NIF
Plants
Consolidation to laboratories, NTS, and/or downsizing in place
Manufacturing and surveillance transition complete (Pantex, Kansas City, Savannah River, Oak Ridge)
Rocky Flats nuclear operations closed
Consolidation of nonnuclear operations completed (Mound, Pinellas, Rocky Flats closed)
Stockpile size
START II effective
1990
1995
2000
2003
2005
2010
Fiscal Year

Figure 3. *Summary of the facility closure, consolidation, and construction, activities of the Stockpile Stewardship and Management Program.*

confidence, judgment, and people is the reason that the competency and experience of our weapons scientists and engineers are so crucial to the U.S. nuclear weapons program. As a result, maintaining this competency base, which exists primarily at the weapons laboratories, is one of the highest priorities of the Stockpile Stewardship and Management Program. We need to preserve and pass on the competency base developed during the years when nuclear testing was permitted. It is this need that drives our efforts to retain the staffs of test-experienced weapons scientists and engineers and to attract talented new people to the program. In turn, these efforts are behind our push to maintain the weapons laboratories with their reputations for scientific and technical excellence, to engage in research and development programs that are nationally important and technically challenging, and to support state-of-the-art experimental facilities and technical capabilities.

Peer Review

Throughout the history of the U.S. nuclear weapons program, we have compensated for less-than-complete knowledge about the physical phenomena governing nuclear weapon operation with nuclear testing and interlaboratory peer review. Without nuclear testing, confidence in the safety and reliability of U.S. nuclear weapons must be based more on judgment and less on data. Peer review is more important now than ever before because judgment-based confidence relies on the knowledge that the judgment has withstood scrutiny. Thus it is essential that we preserve an independent review process.

Clearly then, preserving high confidence in the safety and performance of the enduring U.S. stockpile without nuclear testing will require an improved, more complete, more accurate understanding of the underlying physical principles involved in nuclear weapons. In turn, this will require new experimental capabilities and greatly improved computational capabilities. As these new capabilities come "on line" and we gain experience in their use and demonstrate the validity of the information they provide, we believe we will be able to certify the safety and performance of the stockpile. (Figure 3 summarizes the activities of the Stockpile Stewardship and Management Program.)

Science-based stewardship and management of the U.S. stockpile has never been done before. Meeting this challenge will be neither inexpensive nor without risk. However, if the strategies laid out by the Stockpile Stewardship and Management Program are followed, both in the near term and the long term, we have confidence that we will be able to successfully meet this new challenge.

Appendix: New Facilities

Proposed New Facilities

The following new facilities are included in the Department of Energy's National Security Five-Year Plan. Construction and operation of these facilities is subject to approval at the appropriate Key Decision stages of the Department's major systems acquisition process and to future budget decisions.

Dual Axis Radiographic Hydrodynamic Test Facility

The Los Alamos Dual Axis Radiographic Hydrodynamic Test (DARHT) facility would provide substantial improvements in dynamic radiography, which is a major experimental tool for addressing issues of weapon safety and reliability and for validating our physics understanding of and predictive capability for primaries. This facility would produce radiographic images with significantly higher spatial resolution and illumination intensity than are possible with present facilities. The dual-axis capability of DARHT would provide data on implosion symmetry as a function of time. Improvements in hydrodynamic testing capabilities, by which we can probe the implosion of primaries and assess other weapon hydrodynamic effects, are key to our ability to address stockpile reliability and safety issues by means other than nuclear testing. These hydrotesting improvements are also essential for validating improved numerical codes and models of weapon performance.

The construction of DARHT has been halted by court action. Whether or not construction is resumed will depend on the outcome of an environmental impact statement now being prepared and a record of decision that will follow.

Contained Firing Facility

The Contained Firing Facility (CFF), an addition to the Flash X-Ray (FXR) hydrodynamic testing facility at Lawrence Livermore, would provide for well-diagnosed, contained hydrodynamic tests with up to 60 kg of energetic explosives as well as new diagnostics for improved studies of the behavior of weapon materials under explosive shock conditions.

National Ignition Facility

The National Ignition Facility (NIF) would simulate, on a small but diagnosable scale, conditions of pressure, temperature, and density close to those that occur during the detonation of a nuclear weapon. With the NIF, it would be possible in the laboratory, for the first time ever, to study radiation physics in a regime close to that of secondaries. The NIF would be used to investigate hydrodynamic and mix phenomena relevant to modern nuclear weapons. The NIF would also provide a unique laboratory capability for studying thermonuclear ignition and burn of dense deuterium-tritium gas. Furthermore, by studying NIF-heated targets, we would be able to improve our ability to predict the effects of x-radiation on weapon components and weapon systems; these studies would be a valuable complement to experiments at other Department of Defense and Department of Energy facilities.

Without the capabilities offered only by the NIF, uncertainties about some physics areas that affect secondary performance would go unanswered, and improvements in our predictive capabilities would suffer. Equally important, without the NIF and similar frontier-expanding facilities, the weapons laboratories would find it increasingly difficult to maintain the necessary expertise and skill bases unique to nuclear weapons and essential for science-based stockpile stewardship and management.

Atlas Facility

The pulsed-power Atlas Facility at Los Alamos would provide implosions of centimeter-scale metallic shells for high-resolution experiments related to secondary hydrodynamics. It would also provide a long-pulse-width, soft-x-ray source for radiation-flow experiments scaled to secondary channel conditions. In addition, Atlas would be used for large-scale hydrodynamic experiments with high-fidelity primary pressures to resolve issues related to implosion stability and boost-gas mixing. Atlas would help us gain a more complete understanding of hydrodynamic and radiation-flow phenomena, improve our predictive capabilities, and assist in our efforts to ensure essential nuclear weapon skill and judgment bases.

Process and Environmental Technology Laboratory

The Process and Environmental Technology Laboratory (PETL) at Sandia would support efforts in advanced and environmentally benign manufacturing, specialty materials formulation, materials aging, and analysis. This materials research facility would also support almost all aspects of nonnuclear component development and production engineering. It would be used for the development of advanced stockpile surveillance technologies, the assessment of age-related defects identified during routine surveillance, and the development of cost-effective manufacturing technologies for retrofit and replacement components. The PETL would replace a number of existing facilities distributed throughout Sandia, some of which would require modification to meet current safety standards in order to be used for planned stockpile stewardship activities. Upgrading existing facilities to meet current safety standards would cost more than the cost of constructing this new facility; even with upgrades, existing facilities would not be able to provide the improvements in operating efficiencies offered by the PETL.

New Facilities under Consideration

A number of additional new facilities are under consideration to meet the challenges of science-based stockpile stewardship and management. Depending on the outcome of the PEIS process, other facilities or major upgrades of existing facilities may be needed.

Integrated Design and Development Center

The Integrated Design and Development (ID&D) Center at Sandia would enable the development and validation of tools for establishing the low-cost supply of nonnuclear components (needed to maintain or upgrade stockpile weapons). It would enable integrated optimization of product designs and manufacturing processes to ensure rapid product realization of highly reliable components at the lowest possible cost. The ID&D Center would also serve as a testbed for rapid prototyping and as a source for specialized products not available from industry.

Advanced Hydrotest Facility

The Advanced Hydrotest Facility (AHF) would provide up to eight radiographic views (compared to the two views that would be provided by DARHT). Such multiple-view, multiple-time radiography is anticipated to be essential for assuring weapon reliability and safety without nuclear testing in the long term. The AHF would provide multiple images (20 or more) that would reveal the evolution of a primary's implosion symmetry and boost-cavity shape under normal conditions and in accident scenarios. The AHF would be based on new and developing accelerator technology, which draws on the rapidly advancing state of the art in high-power, high-speed, solid-state components.

Jupiter Facility

The Jupiter Facility would be an advanced pulsed-power x-ray source to provide enhanced capabilities in areas of weapon physics, radiation-effects science, and pulsed-power technology. It would provide a class of x-ray environments that can be obtained elsewhere only in underground nuclear tests. This facility would enhance our ability to certify that critical weapon components meet military requirements for x-ray hardness.

High-Explosive Pulsed-Power Facility

The High-Explosive Pulsed-Power Facility (HEPPF) would provide experimental capabilities for studying secondary physics issues at shock pressures and velocities approaching those of actual weapon conditions at scale sizes and pulse widths needed to validate numerical simulations. High-explosive pulsed power is a cost-effective means for producing the extraordinary electrical pulses needed for these experiments. This facility would significantly enhance our predictive capabilities regarding secondary aging and remanufacturing.

Laboratory Integrated Simulation and Computer Center

The Laboratory Integrated Simulation and Computer Center (LISAC) would replace the 1950s facility currently housing Sandia's mainframe computers. It would increase the efficiency and effectiveness of Sandia's computer operations and provide a collaborative setting for the development of advanced software, operating systems, and peripheral equipment. The highly interactive environment made possible by the LISAC would also help attract computer experts to Sandia for extended temporary assignments, a central element of the Accelerated Strategic Computing Initiative (ASCI).

Glossary

agile manufacturing	Effective use of equipment and people, involving time-sharing of expensive equipment and broader responsibilities for workers on the manufacturing floor, to rapidly and cost effectively meet the needs of high-quality, low-volume production.
boost	The process by which fusion of deuterium–tritium gas inside the pit of a nuclear weapon produces neutrons that increase the fission output of the primary.
burn	Fusion of two light nuclei (usually deuterium and tritium) to form a heavier nucleus (helium) accompanied by the release of neutrons and energy.
common mode failure	A failure or defect affecting an entire class of weapon or weapon component; a particular concern with the enduring stockpile since it contains about seven weapon systems, many of which use identical components, components with common design features, or components manufactured using identical or similar processes.
computational modeling	The use of a computer to develop a mathematical model of a complex system or process and to provide conditions for testing it.
concurrent engineering	Concurrent design of both the product and the processes for manufacturing the product; integrated design, production, prototyping, and product qualification.
detonation	An exothermic chemical reaction that propagates with such rapidity that the rate of advance of the reaction zone into the unreacted material exceeds the velocity of sound in that material; that is, the advancing reaction zone is preceded by a shock wave.
empirical	Something that is based on actual measurement, observation, or experience rather than on theory.
enduring stockpile	The U.S. nuclear stockpile of the future, consisting of about seven weapon systems (many of them older than their design lifetime), with no new systems added to the stockpile for the foreseeable future.
explosion (conventional)	A chemical reaction or change of state that occurs in an exceedingly short time with the generation of high temperatures and large quantities of gaseous reaction products.

explosion (nuclear)	An explosion for which the energy is produced by a nuclear transformation, either fission or fusion. The term typically implies the release of enormous amounts (kilotons) of energy.
fission	Nuclear reaction in which a heavy nucleus is split apart to form two or more lighter nuclei, accompanied by the release of large amounts of energy and various forms of ionizing radiation.
fusion	Nuclear reaction in which light nuclei are fused together to form a heavier nucleus, accompanied by the release of immense amounts of energy and fast neutrons.
high explosive	An energetic material that detonates (instead of deflagrating or burning); the rate of advance of the reaction zone into the unreacted material exceeds the velocity of sound in the unreacted material.
hydrodynamic test	High-explosive nonnuclear experiment to investigate hydrodynamic aspects of primary function up to mid to late stages of pit implosion.
hydrodynamics	The study of the motion of a fluid and of the interactions of the fluid with its boundaries, especially in the case of an incompressible inviscid fluid.
hydronuclear experiment	Very-low-yield experiment (less than a few pounds of nuclear energy released) to assess primary performance and safety with normal detonation.
ignition	Self-sustained fusion burn of light nuclei.
implosion	The sudden inward compression and reduction in volume of fissionable material with ordinary explosives in a nuclear weapon.
limited-lifetime component	A weapon component that decays with age and must be periodically replaced.
microelectronics	Integrated circuits and electronic devices constructed of individual circuit elements with dimensions of micrometers (10^{-6} m) on a carrier with dimensions of a centimeter (10^{-2} m).
mix	Mixing of materials, usually with different densities and velocities, that can adversely affect nuclear weapon performance.

nondestructive evaluation	Test method that does not involve damage to or destruction of the test sample; includes the use of ultrasonics, radiography, magnetic flux, and other techniques.
noninvasive imaging	Imaging method that does not damage the test specimen; includes radiography, computed tomography, and other techniques.
nonnuclear component	Any one of thousands of parts that do not contain radioactive or fissile material that are required in a nuclear weapon.
nonproliferation	Preventing the spread of nuclear weapons, nuclear weapon materials, and nuclear weapon technology.
nuclear assembly	Collective term for the primary, secondary, and radiation case.
nuclear component	A part of a nuclear weapon that contains fissionable or fusionable material.
nuclear weapon	The general name given to any weapon in which the explosion results from the energy released by reactions involving atomic nuclei, either fission, fusion, or both.
nuclear weapons complex	The collection of laboratories and production plants involved in the design, production, and testing of nuclear weapons.
nuclear warhead	A warhead that contains fissionable and fusionable material the nuclear assembly and nonnuclear components packaged as a deliverable weapon.
numerical simulation	The use of mathematical algorithms and models of physical processes to calculationally simulate the behavior or performance of a device or complex system.
performance	The ability of a nuclear weapon or weapon system to operate in specified manner (e.g., yield, range, accuracy, radiation spectrum) under stated conditions. (Essentially equivalent to reliability.)
reliability	The ability of a nuclear weapon, weapon system, or weapon component to perform its required function under stated conditions for a specified period of time. (Essentially equivalent to performance.)

retrofit	To furnish (e.g., a weapon) with new parts, equipment, or features not available at the time of manufacture.
safety	Minimizing the possibility that a nuclear weapon will be exposed to accidents and preventing the possibility of nuclear yield or plutonium dispersal should there be an accident involving a nuclear weapon.
security	Minimizing the likelihood of unauthorized access to or loss of custody of a nuclear weapon or weapon system, and ensuring that the weapon can be recovered should unauthorized access of loss of custody occur.
simulant material	Materials used to modify a weapon pit to prevent the device from becoming critical.
special nuclear material	A specific list of materials including plutonium and uranium, among others.
stockpile management	The specific tasks and functions involved in managing the stockpile weapons, including production, routine surveillance and servicing, assembly and dismantlement, and disposal of weapons-related parts and materials.
stockpile stewardship	The science and technology aspects of ensuring the safety, security, and reliability of the stockpile, including research and development to provide the technologies required for stockpile management.
stockpile surveillance	Routine and periodic examination, evaluation, and testing of stockpile weapons and weapon components to ensure that they conform to performance specifications and to identify and evaluate the effect of unexpected or age-related changes.
surety	Umbrella term for safety, security, and use control.
system integration	The process by which individual components are engineered into a system that meets performance requirements.
test readiness	Maintaining the critical technologies, staff skills, and infrastructure to be able to resume nuclear testing if and when mandated by the President.

thermonuclear	The process by which very high temperatures are used to bring about the fusion of light nuclei, such as deuterium and tritium, with the accompanying release of energy.
use control	Delaying or preventing the unauthorized use of a nuclear weapon or weapon system while allowing timely authorized use.
warhead	Collective term for the package of nuclear assembly and nonnuclear components that can be mated with a delivery vehicle or carrier to produce a deliverable nuclear weapon.
weapons laboratories	Colloquial term for the three Department of Energy national laboratories—Los Alamos, Lawrence Livermore, and Sandia—that are responsible for the design, development, and stewardship of U.S. nuclear weapons.
weapon system	Collective term for the nuclear assembly and nonnuclear components, subsystems, and systems that comprise a nuclear weapon.

Senator EXON. Dr. Smith, has the Stockpile Stewardship plan been shared with your office? Do you find it adequate?

Dr. SMITH. The Stockpile Stewardship plan has not been formally submitted to DOD for review. It would, therefore, be premature to provide a Department of Defense opinion on the plan's adequacy.

MONITORING AND SAFETY OF EXISTING WEAPONS

Senator EXON. Secretary Reis, with the closing of most of the former production complex and your planned consolidation, what assurance can the committee have that adequate capability will remain in each of the following areas:

Monitoring the safety and reliability of existing weapons in the stockpile.

Mr. REIS. DOE monitors safety and reliability through a ongoing stockpile evaluation program. Weapons in the enduring active stockpile (AS) are sampled each year by randomly selecting 11 units per "family" (e.g., the B61–3, B61–4, and B61–10 are considered one family). These samples support a 90/90/2 sampling plan that provides a 90 percent probability of detecting a 10 percent defect in a 2 year interval.

With regard to the inactive stockpile (IS), testing is performed periodically to assure weapon safety but not weapon reliability. Sampling plans for the IS are defined in the following three categories:

(1) IS weapons stored in different locations, experiencing different environmental conditions, and/or in different configurations than active stockpile (AS) weapons are sampled at a rate of three weapons every 3 years;

(2) IS weapons collocated, experiencing the same environmental conditions, and configured the same as AS weapons do not require additional safety testing; and

(3) A weapon system designated entirely as IS is sampled at a rate of three weapons every 2 years.

This stockpile evaluation activity is largely performed at Pantex and the weapons laboratories which have been unaffected by plant closures. Some testing capabilities were identified for transition from closing sites to receiver sites as part of the Nonnuclear Reconfiguration Program and plans are in place to reestablish these capabilities.

Senator EXON. Diagnosis of possible safety problems through improved modeling and simulation and enhanced computational capabilities.

Mr. REIS. While new weapon production has ceased, and many production facilities closed, the ability to design nuclear weapons, analyze their performance, predict their safety and reliability, and certify their functionality as they age is essential for management of the enduring stockpile. To meet the needs of stockpile stewardship, weapon application codes must achieve higher-resolution, three-dimensional, enhanced-physics, and full-system capabilities. To meet this challenge Defense Programs has developed the Accelerated Strategic Computing Initiative (ASCI). ASCI will create virtual-testing and prototyping capabilities based on advanced weapon codes and high performance computing. The program will provide the ability to evaluate, maintain, and prototype nuclear weapons and weapons components in the absence of underground nuclear testing and with a downsized weapons manufacturing infrastructure.

Because it will be smaller and less diverse, the enduring U.S. stockpile will be more vulnerable to single-point and common-mode failures (i.e., failures or defects compromising the safety or reliability of, respectively, a single weapons system or several systems sharing a common design feature). New surveillance technologies, coupled with enhanced predictive capabilities as to the effects of materials aging on component and weapon performance, are needed so that we can detect potential safety or reliability problems long before they become serious. ASCI will create the computational predictive capability needed for stockpile stewardship.

Senator EXON. Dismantlement of weapons to be retired, including safely resolving dismantlement problems.

Mr. REIS. The Department will maintain a capability to dismantle U.S. nuclear weapons in a safe and environmentally acceptable manner. Dismantlement of nuclear weapons requires a formal conduct of operations process that ensures efficient, effective and safe operations. The safety process requires positive verification of conformance to quality requirements including safety criteria. The safety criteria established employ hazard assessments concurrently with process development to support the concept of "Designing in" verses "reviewing in" requirements. This is accomplished through verifiable safety criteria including nuclear explosive safety studies, disposition of radioactive material, occupational and environmental safety and the application of as low as reasonably achievable principle for personnel exposure to radiation and other hazardous materials. This process is being implemented at Pantex as well as all facilities that perform dismantlement related activities.

Senator EXON. Design, construction and installation of "replacement" parts for components of weapons that are, or are found in the future to be, subject to deterioration.

Design, construction and fabrication of replacements for stockpile weapons that are found to be unsafe, or subject to severe deterioration, in the future.

Mr. REIS. The weapons laboratories continue to maintain the design and qualification capabilities necessary for replacing components that have deteriorated. Much of the capability to manufacture and install components also remains intact at Pantex, Kansas City, Savannah River, Y–12, and the weapons laboratories. Under the Nonnuclear Reconfiguration Program, DOE has conducted a very detailed planning effort to identify and protect all technologies and capabilities required to support the enduring stockpile weapons. The program will transfer the manufacturing capabilities for nonnuclear weapon components from the closing production facilities to other DOE sites. Priority is placed on activities with currently known production schedules such as the tritium reservoir. Technology will be retained to reestablish the production capability for those activities without a currently known production requirement This program is already underway and significant progress has been achieved. Some risk is associated with any major new production requirements until these activities have been qualified at the receiver sites.

Senator EXON. Given the aging of the nuclear weapons design personnel, retaining an adequate *weapons physics*—as distinct from engineering and technical cadre of personnel.

Mr. REIS. The highest priority of the Stockpile Stewardship and Management Program is to ensure the safety, reliability, and performance of the enduring stockpile by the preservation and expansion of the core intellectual and technical competencies of the United States in the field of nuclear weapons. The Department's "Stockpile Stewardship and Management Program," document provides broad guidance for all future weapons activities within Defense Programs. This program document addresses possible issues caused by aging and downsizing of the engineering and nuclear design staffs and recognizes the need to establish programs to preserve and pass on the knowledge base developed during the years when nuclear testing was permitted. This requires an improved, more complete, more accurate understanding of the underlying physical principles involved in nuclear weapons. In turn, this document advocates new experimental capabilities, such as DARHT and NIF, and recognizes the need for greatly improved computational capabilities to enable us to maintain an adequate weapons physics cadre of personnel and the knowledge and skill base that is essential for training new weapons program personnel.

Meanwhile, DOE does continue to have a active program to design, produce, and replace components for safety and security upgrades to existing weapon system. In addition, DOE is pursuing the means to reestablish, support activities involving nuclear components. Los Alamos National Laboratory will have the capability to support pit rebuild requirements starting in fiscal year 1997. The plan for long-term capability to support nuclear components will be determined in the Record of Decision following the completion of the Stockpile Stewardship and Management Programmatic Environmental Impact Statement, currently scheduled for 1996. The question of replacing unsafe or deteriorated weapons is basically a extension of the problem of replacing components. A weapon would be deemed unsafe due to deterioration or failure of individual components or a subset of components. All components do not deteriorate at the same rate and thus would not require replacement all at once. DOE would have the capability to replace the components and return the weapon to a safe and reliable status.

DOD VIEW OF DOE PROGRAMS

Senator EXON. Dr. Smith, what is the Defense Department's view of the adequacy of the DOE's plan in each of these areas?

Dr. SMITH. DOD will be able to comment on the adequacy of the DOE plan when a detailed, technically oriented version has been formally submitted for our review.

[Whereupon, at 6:02 p.m., the subcommittee adjourned.]

DEPARTMENT OF DEFENSE AUTHORIZATION FOR APPROPRIATIONS FOR FISCAL YEAR 1996 AND THE FUTURE YEARS DEFENSE PROGRAM

THURSDAY, MAY 18, 1995

U.S. SENATE,
SUBCOMMITTEE ON STRATEGIC FORCES,
COMMITTEE ON ARMED SERVICES,
Washington, DC.

BOMBER FORCE ISSUES

The subcommittee met, pursuant to notice, at 3:08 p.m., in room SR–222, Russell Senate Office Building, Senator Trent Lott (chairman of the subcommittee) presiding.

Committee members present: Senators Lott, Thurmond, Warner, Smith, Hutchison, Inhofe, Nunn, Exon, and Glenn.

Armed Services Committee staff members present: Richard L. Reynard, staff director and Roslyne D. Turner, systems administrator.

Professional staff members present: Romie L. Brownlee, Jonathan L. Etherton, Stephen L. Madey, Jr., John H. Miller, Steven C. Saulnier, and Eric H. Thoemmes.

Minority staff members present: Arnold L. Punaro, minority staff director; Andrew S. Effron, minority counsel; Creighton Greene, William E. Hoehn, Jr., and Michael J. McCord, professional staff members.

Staff assistants present: Shelley G. Lauffer and Deasy Wagner.

Committee members' assistants present: Samuel D. Adcock, assistant to Senator Lott; Grayson F. Winterling and Judith A. Ansley, assistants to Senator Warner; Richard F. Schwab, assistant to Senator Coats; Thomas L. Lankford, assistant to Senator Smith; Glen E. Tait, assistant to Senator Kempthorne; George K. Johnson, assistant to Senator Hutchison; Matthew Hay, assistant to Senator Inhofe; Richard W. Fieldhouse, assistant to Senator Levin; John P. Stevens, assistant to Senator Glenn; and Lisa W. Tuite, assistant to Senator Byrd.

OPENING STATEMENT OF SENATOR TRENT LOTT, CHAIRMAN

Senator LOTT. We will get started now. We have other Senators who are very interested in this hearing today, and I am sure they will be coming in later. I understand the distinguished ranking member is on the floor with the budget resolution, so we expect him to arrive later.

I would like to advise the witnesses that we will be glad to submit your statements for the record. I understand, General Loh, you have a short, strong statement and that you will summarize that. Mr. Secretary, I hope also that you could summarize yours. I realize you have a lot you need to say, but if we could get some summarization so that we could put it in the record and have time for questions, we would appreciate your doing that.

I am pleased to welcome our witnesses here today for what, in my opinion, has become a defining moment for the bomber program. Last year the Armed Services Committee provided funds to keep the B–2 production base alive pending the results of a study of the heavy bomber force. I thought that was the appropriate thing to do at the time. We needed this study, and I have been waiting anxiously for the results of that study. It was delayed somewhat, but now we will have a chance to take a look at it and hear the explanation today.

Under the law that study was to have been completed and submitted by April 15. In January at a posture hearing, I asked Dr. Perry to get us the study on time. We had originally scheduled this hearing for May 9, expecting to have more than enough time for that study when it was due.

However, that was not enough time, even though the study was released on May 3, because I understand that Dr. Kaminski had to be out of the country and could not be here when we had the schedule set earlier. But I regret that we are a little bit behind the schedule here today and I want to express some frustration and disappointment right up front on the timing, and then I will let you know how unhappy I am with the study later on. [Laughter.]

This would not be such an issue, of course, if we had a really coherent plan for where we need to go with the bomber force. Last year, I said that I could go with any one of these plans but that we needed to decide what it was going to be. I do not feel any more secure about that now than I did a year ago. But the Bottom-Up Review's inconsistencies and uncertainties regarding bombers, among other things, have really caused problems in the committee being able to make the right decision.

Now with time running short and a lengthy study before us, we again face the task of sorting out the important from the trivial and making sense of an intricate force structure question. I intend to provide a balanced forum for discussion of this issue since it potentially represents one of the largest resources that we might have to deal with and because of the divergent views on this issue and the budget restraints we have to deal with. But in any case, this is an issue we must decide now.

The Defense Department, through Dr. Kaminski's letter to the Chairman and ranking member of the committee, clearly recommends against further B–2 acquisitions and for accurate guided munitions for the bomber force. While the Defense Department's recommendations are clear, questions remain about the wisdom of those recommendations and some say even about the study itself. I hope today's hearing will go a long way toward resolving those doubts and questions or at least to a common understanding of the issue.

I would be glad to yield to the distinguished former chairman of our full committee for any statement he would like to make before we recognize the witnesses.

Senator NUNN. Thank you, Mr. Chairman. I am pleased that you are having this hearing today and I know Senator Exon is very interested in the subject and will be here when he can. We are just beginning the budget debate, and as the ranking Democrat, he has to be on the floor for that debate.

I look forward to testimony we are going to have today. I was one of those who believed we needed to have this kind of study. We will have a lot of questions as we go along.

I do not quarrel with the people who analyzed the IDA study. I do think that we have to examine very closely some of the assumptions. The assumptions drive the outcome very heavily here. The warning time, the robustness, the deployability, the survivability of our non-bomber forces are a key part of the assumption, and there are other assumptions.

For instance, I understand that we have assumed that two carrier battle groups are on station at the beginning of the war. I understand that we assume that we deployed more than 500 fighters in less than 1 week's time despite the fact it took over 5 weeks to get 500 aircraft to Desert Storm, and many of them came from Europe rather than the United States.

I think the assumptions also assume no logistics or sustainability problems despite the very rapid deployment of a huge number of forces. Also, there seems to be little in the way of a ballistic missile threat assumed here.

But these assumptions do not simply go to the bomber question. These assumptions are used throughout the whole Bottom-Up Review. We perhaps, over a period of years, have been put in a situation where people could say that there was a "worst case" kind of assumption scenario during the Cold War. I do not share that, but that has been a criticism. But it seems to me that you can turn it around on the Bottom-Up Review and say that in many instances the assumptions in the Bottom-Up Review are the "best case." They may end up, hopefully, a realistic case, but that is a real big question in my mind.

So, to me it is not the analysis that is questioned here and it is not simply the bomber question that is at stake, but it is a real question of the fundamental assumptions on which we are now basing our entire force structure. That is a much bigger question than simply the B–2 question.

So, I look forward to the testimony about the B–2 and the future projections for the need or lack of need for the B–2. But, I also look forward not just in this hearing but in others, as we have the Secretary of Defense and others, to getting into the assumptions that are driving our basic force structure today.

Senator LOTT. Senator Smith.

Senator SMITH. I have no statement.

Senator LOTT. Our witnesses on the first panel are Hon. Paul G. Kaminski, Under Secretary of Defense for Acquisition and Technology, and Gen. John M. Loh, U.S. Air Force Commander, Air Combat Command.

Senator Hutchison, shall we proceed or do you want to make any opening statement?

Senator HUTCHISON. Please proceed.

Senator LOTT. Secretary Kaminski, thank you very much for being here.

STATEMENT OF HON. PAUL G. KAMINSKI, UNDER SECRETARY OF DEFENSE FOR ACQUISITION AND TECHNOLOGY

Dr. KAMINSKI. Thank you, Mr. Chairman. If I may, I would like to submit my formal statement for the record and then just do a brief verbal introduction. I have a viewgraph presentation to summarize the results of the study.

Senator LOTT. It will be made a part of the record.

Dr. KAMINSKI. Mr. Chairman, my first involvement with long-range bomber force issues dates back to 1977 when I worked as special assistant to then-Under Secretary of Defense William Perry. I was fortunate to be involved at that time in establishing the framework for what has become known today as our stealth programs, to include what eventually became the F–117 and the B–2.

I was reassigned after the change in administration to be the Director of Low Observables Technology while still on active duty, at which time the F–117 was entering production and source selection for the B–2 was being completed under my directorship.

So, for me heavy bomber studies and the employment of stealth technology and the B–2 bomber are all familiar landmarks along the path that I first traveled down some 17 years ago.

To provide you with some framework for the assessment that we want to report on today, let me give you a little bit of the background. We proceeded by requesting our operational and acquisition communities in the Joint Staff and the services to define our existing and planned bomber force's conventional capabilities and what would be the best use of those capabilities should we find ourselves involved in a future conflict scenario involving two nearly simultaneous major regional conflicts (MRCs). We challenged our intelligence community to project what capabilities our most likely adversaries would possess in the future years of 1998, 2006, and 2014. So, we reported results for each of those time frames in the study.

Based on that information, we have analyzed the capability of our planned bomber force to meet the national security requirements of fighting two near simultaneous MRCs. Because we know that our ability to accurately project in the future is less than perfect, we also analyzed alternatives to our planned bomber force and evaluated numerous excursions to changes in warning times, threats, force arrival projections, the weapons inventories that we used, the weapons effectiveness, and various other key parameters that impacted the outcome.

The analysis that I am referring to is known as the Fiscal Year 95 Heavy Bomber Force Study, and what I would like to do now is provide you with a summary of this work. I believe this is the most significant and comprehensive study to date that has considered the use of all three heavy bombers in the conventional warfighting role in conjunction with other United States and allied ground, naval, and air forces.

I believe that an accurate summary can be presented in an unclassified forum in an open session, but the details of the study must remain classified and protected because the data used in the conduct of the study was obtained from our actual war planning documents. We can go into any of those assumptions or underlying planning factors in a closed session. We are prepared to deal with those as they come up.

Congressional Direction

FY 95 Authorization Act

Section 133--"The Secretary of Defense shall carry out a study of Bomber force requirements of the DoD. ..." Due April 15, 1995

Section 133 (b)(c)--"Determine those core bomber industrial capabilities that are needed to maintain the ability to design, develop, and produce bomber aircraft in the near-term and in the long term ..." Due July 1, 1995

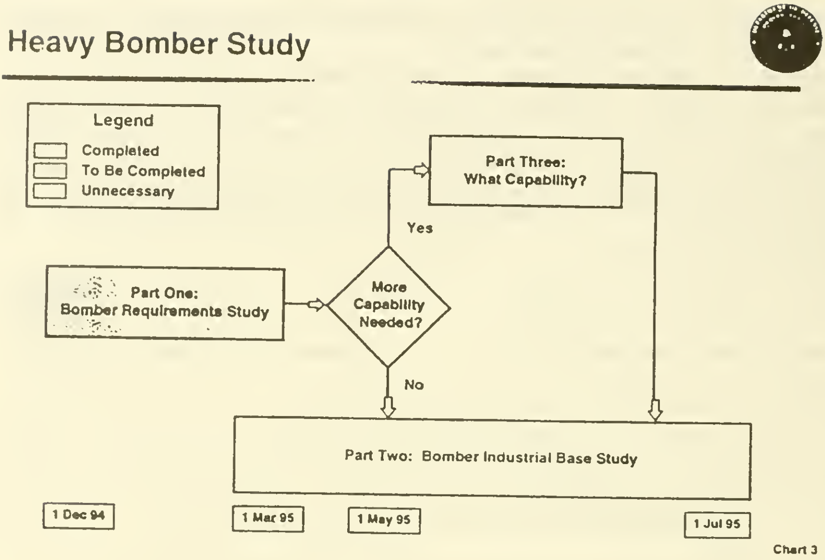
Section 133 (d)--Authorizes not more than $125M for an Enhanced Bomber Capability Fund. $100M for studies, and for preserving core capabilities. If new bomber needed, $25M to begin a conventional-conflict-oriented, lower cost, next-generation bomber.

FY 95 Appropriations Act

Section 8101--"Not later than May 1, 1995, the Secretary of Defense shall submit to the Committees on Appropriations of the House and Senate an independent cost-effectiveness study of Air Force bomber programs."

Chart 2

If I might start with the briefing, the first chart is a summary of the congressional language which formed the framework for this activity. There was authorization language and appropriations language as well.



The next chart indicates the approach to the study, what we are describing here today as part 1, a bomber requirements study. Part 2 is the related bomber industrial base study.

If I may, Mr. Chairman, let me give you a four-point bottom line summary of the results and then go through the individual charts to back up the briefing.

The first point is that we have now completed this first green box, the bomber requirements study, and the results of this study do not make the case for buying additional B–2s.

The second point is that this green box, the bomber requirements study, is in my opinion the most comprehensive study of bomber force structure that I have been associated with in 17 years working in this area. The study included all the relevant forces that would be involved in a future two-MRC scenario and all the planning assumptions that the Department uses to size Bottom-Up Review forces, and it is the guidance and the planning base that we are currently using in our entire defense planning guidance. These are the same underpinnings we have used to size the rest of the Department's forces and force structure.

Point three is that our study shows the overwhelming importance that tactical air (TACAIR) forces play in this two-MRC scenario and the fact that one cannot ignore the impact of tactical air forces in making bomber force structure decisions, as have many other studies in the past which have looked at bombers alone.

The key point to be made here is that we need to be sure that we have tested the major assumptions and the uncertainties associated with the employment of tactical air power. This includes where and how the TACAIR arrives, how fast it arrives, and the potential for constraints on the use of our TACAIR bases.

We have worked in earnest to illuminate these issues and, Mr. Lott, I, myself, must take credit for all the delays in these studies.

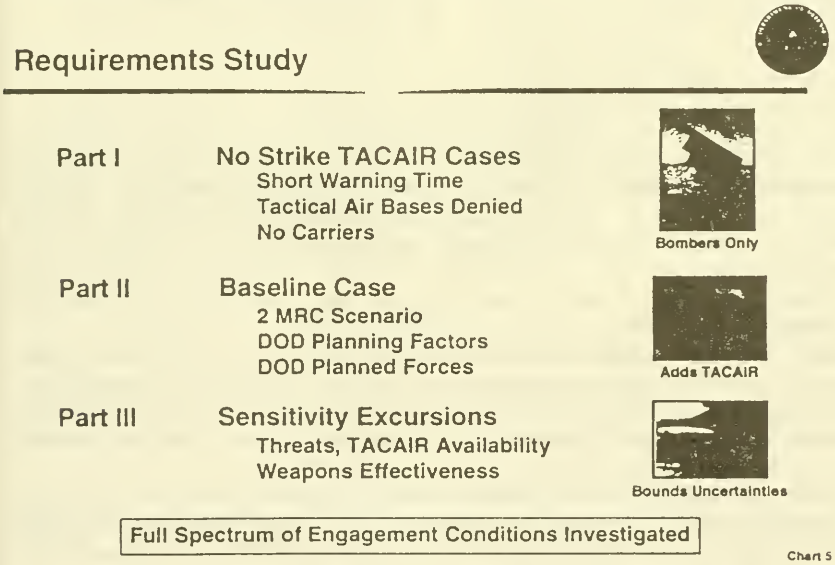
I, in fact, delayed the completion of this work until I was personally satisfied that we had looked at all these excursions on warning times and force arrival and all the related issues so that we had sufficiently illuminated the cases. I was the culprit who delayed the results until I was satisfied.

The fourth point is that the study does show that additional value is provided by more B–2s, but what it also illuminates is the much greater cost effectiveness that could be derived from procuring greater quantities of advanced, accurate guided weapons to leverage not only the bombers, but all the rest of our tactical air forces as well. Additionally, it shows that conventional bomber upgrades that we looked at in the study are also cost effective and necessary.

If I may now proceed with the rest of the charts. What I am reporting now is what is in the green box, part 1, and the answer is, more capability needed? No.

That takes us to the bomber industrial base study which is currently underway. We expect a report back on that study in early July.

As we conducted this review, we had a steering committee, an executive committee, which overviewed all the results and the assumptions. This chart shows the composition of that committee. It includes representatives from the Office of the Secretary of Defense, the Joint Staff, and each of the services.


Requirements Study

Part I No Strike TACAIR Cases
- Short Warning Time
- Tactical Air Bases Denied
- No Carriers

Bombers Only

Part II Baseline Case
- 2 MRC Scenario
- DOD Planning Factors
- DOD Planned Forces

Adds TACAIR

Part III Sensitivity Excursions
- Threats, TACAIR Availability
- Weapons Effectiveness

Bounds Uncertainties

Full Spectrum of Engagement Conditions Investigated

Chart 5

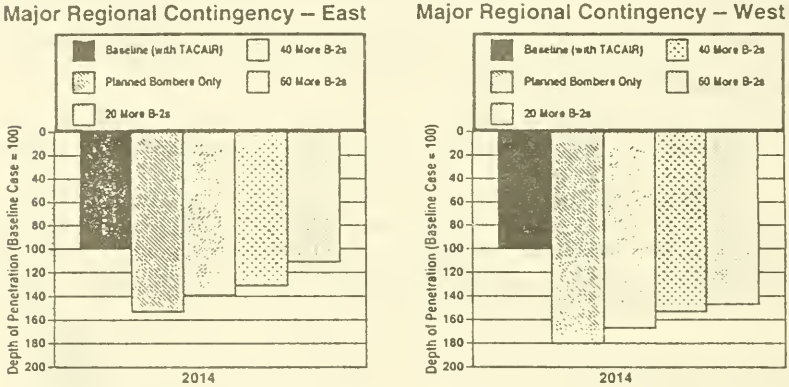
What I would like to do now is present the findings of the study in three parts. This first part I call the “no strike TACAIR case.” We have had a lot of discussion about this study in terms of assumptions on warning time and the impact of tactical air.

So, we did a set of scenarios here in which there were no strike tactical aircraft available in the first 15 days of the conflict. This includes assumptions, in essence, of short or no tactical warning time, the denial of all of our tactical air bases, including the bases in-theater, and the lack of presence of any carriers to affect the conflict. So, for the first 15 days, this is bombers only other than a small amount of support from in-theater air superiority resources.

We also did this to compare with other studies which have looked at bombers only. Let me report on the output of this case.

No Strike TACAIR Cases

Forward Line of Troops Movement*



* Depth of Penetration by Opposing Forces During Initial Halting Phase (100 = Normalized Penetration Depth Achieved Under Baseline Conditions in 2014 with Unrestricted US and Allied TACAIR Capability)

Chart 6

To make these charts unclassified, what I have done is used a normalizing yardstick. This parameter being reported on is the movement of the forward line of troops into allied territory on the left in our MRC East contingency, on the right in our MRC West contingency.

Moving further down is bad; that is, we are losing more allied territory in the conflict.

Our blue bar represents the baseline case. When we have available to us all of our tactical air and all of our normal assumptions. This is my normalizing factor here; that is, the level of 100 on this chart represents the distance that the forward line of troops moved in our baseline case.

Now, to compare our first excursion, if we look at operating the planned bombers only and no tactical air during this first 15 days, we see that we lose about 50 percent more territory in the movement of the forward line of troops than we did in our baseline case; that is, the absence of that tactical air causes us to lose 50 percent more territory in MRC East.

If we add 20 more B–2s to the force, we now lose only 40 percent more territory. Adding 60 more B–2s causes us to come back to nearly where we were with the tactical air situation. So, in MRC East, we have to add somewhat more than 60 additional B–2s to make up for the absence of that tactical air in the first 15 days.

If we look at the MRC West scenario, we see that the situation is a little more difficult; that is, without the tactical air, we lose 80 percent more territory and adding back 60 B–2 bombers to the force still has us losing 50 percent more territory than our tactical air.

No Strike TACAIR Cases

Presence of strike tactical aircraft dominates the results

60 more B-2s would not fully compensate for an 8-15 day denial of strike tactical air capability

Additional B-2 bombers would help mitigate a delay in tactical aircraft strikes against an enemy advance

Requires:

- Substantial increase in advanced anti-armor munitions
- Forward basing of bombers

Chart 7

The conclusions I draw from this assessment are that the presence of strike tactical air certainly dominates the results. You cannot ignore the presence of tactical air when trying to make an overall decision. You can see the impact that bombers have in the early phases when tactical air is not there.

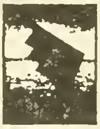
The second conclusion is that 60 more B–2s would not by themselves fully compensate for an additional 8- to 15-day denial of our tactical air capability.

The third point is that additional B–2s would help mitigate a delay in tactical air strikes against an enemy advance as you saw, but doing so requires a substantial increase in advanced anti-armor munitions. We allowed those munitions to be there and available even though we were beyond the inventory for this no TACAIR case. And it also requires forward basing of the bombers.

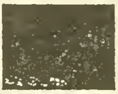
Now, I did this extreme excursion with no TACAIR so we could compare our results with other studies that had no tactical air involved, and the results are certainly similar.

Requirements Study

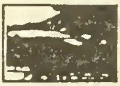
Part I — No Strike TACAIR Cases
- Short Warning Time
- Tactical Air Bases Denied
- No Carriers


Bombers Only

➡ Part II — Baseline Case
- 2 MRC Scenario
- DOD Planning Factors
- DOD Planned Forces


Adds TACAIR

Part III — Sensitivity Excursions
- Threats, TACAIR Availability
- Weapons Effectiveness

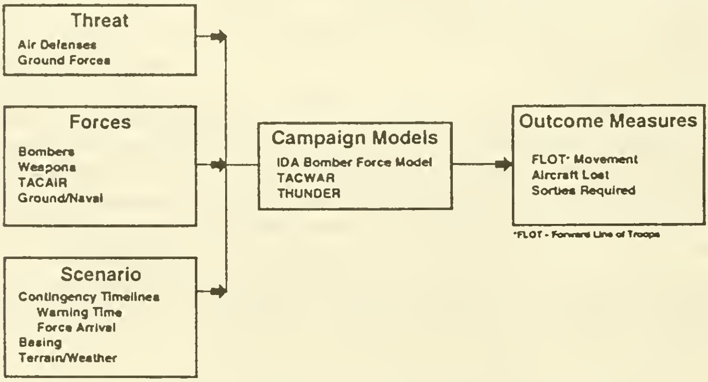

Bounds Uncertainties

Full Spectrum of Engagement Conditions Investigated

Chart 8

What I would like to do now is go to part 2, which is the baseline case. It is our two-MRC scenario. It involves all of our operational planning factors for this scenario, and it involves use of all of our planned DOD forces, aircraft, weapons systems, ground forces, and naval and marine forces.

Campaign Analysis



Thorough Study of Bomber Force Requirements

Chart 9

To do this work, we conducted a campaign analysis that is diagramed in the chart. We first used threats derived from the intelligence community, from DIA, and certified by the national intelligence officer for conventional forces. Those included air defenses and ground forces.

We then took all of U.S. forces, bombers, weapons, TACAIR, and our ground and naval forces. We then constructed a scenario based on our planning factors for warning times and force arrival into the theater and included forces that were already present in the theater with appropriate basing arrangements and used predictions for terrain and weather in that particular theater.

Senator NUNN. Mr. Chairman, could I ask Dr. Kaminski to back up one chart just for clarification of an assumption on the non-TACAIR chart?

Senator LOTT. Certainly.

Dr. KAMINSKI. The bar chart, Senator Nunn?

Senator NUNN. Yes, where you showed no TACAIR. Is this assuming no tactical aircraft are in the theater?

Dr. KAMINSKI. This is assuming no tactical aircraft at all for the first 15 days with the exception of a small number of air superiority aircraft on the order of a wing's worth or less is in the theater. They are doing air superiority only, no tactical strikes.

Senator NUNN. I understand it includes escort aircraft. Is that what you are talking about?

Dr. KAMINSKI. Yes, sir. It includes a small number of air superiority aircraft.

Senator NUNN. And defense suppression aircraft.

Dr. KAMINSKI. No. These aircraft are not doing suppression of ground defenses. The tactical aircraft are there for air superiority cover.

Senator NUNN. I just do not understand the assumption that presumes no tactical air for one purpose but available tactical air for another purpose. You had to assume tactical air was going to be there in order to get your scenario with the existing bombers, but then you put an assumption that you were not going to use tactical air for any kind of strike. I do not understand that. It looks to me like that is a mixed assumption base that probably has no foundation in reality.

Why would you be able to get tactical air in there to escort bombers and to achieve air superiority, but not be able to get tactical air in there for strike purposes?

Dr. KAMINSKI. In this case, these tactical aircraft were already based in the theater. In fact, there are considerably more aircraft than that based in the theater. I simply assumed we could not use all the rest, that we only use a small piece of the air superiority aircraft for that air cover.

This was a similar number, Senator Nunn, to that which was used in other studies with no strike tactical air as well. As many as 40 aircraft were used in the previous studies as well.

But arbitrarily I took out all the strike aircraft, prevented any new aircraft from arriving in the theater, took all the strike aircraft that were in the theater and turned them off, and we used on the order of a wing's worth of aircraft for escort or air superiority.

Senator NUNN. Is that a reasonable assumption, General Loh, based on your knowledge of what might happen?

General LOH. If the aircraft are already in the theater and based there, they could be used to provide air superiority. If they were not already there, then under the assumptions of the study it would be difficult to get them there. So, I think again it is based on how you assume the array of air power at the start of the conflict.

Senator NUNN. Is there any place now, Korea or the Persian Gulf or wherever the likely scenarios might unfold, where we would have that kind of presence of non-strike tactical air but not any strike tactical air? Is that realistic based on the real world as we know it now?

General LOH. If you look at Korea, we do have both air superiority aircraft and strike tactical air in place in Korea. Off and on we have some in the Middle East, but not permanently assigned there. So, the only place where we would have in-place forces that could do this would be on the Korean Peninsula and in Europe where we have permanently assigned forces.

Senator NUNN. But if you cannot get air deployed into the bases, how can fighters already be there flying?

I am just trying to get to the assumption because assumptions drive this whole outcome. You let me make the assumptions and I will get you a different outcome. So, I am just trying to see if the assumptions are realistic.

How is it realistic to say that we will have tactical air flying out of bases, protecting our non-stealthy bomber force, but we cannot get tactical air in there to strike?

Dr. KAMINSKI. Senator Nunn, let me say that I do not think the assumptions for this part 1 analysis are realistic. They have ignored all of our tactical air forces, and I did this just to do an extreme case in which we had no tactical strike resources available to us so that we were looking at the bombers plus only air superiority aircraft.

Senator NUNN. I do not want to interrupt any longer.

Dr. KAMINSKI. I tried to do this extreme case to take all of our strike tactical aircraft out of the picture to see what the result would be.

Back to the baseline case, we took the threat, the forces, in the scenario and used three different campaign models in this assessment: the IDA bomber study force model, which is a large, linear programming model that makes the best use of our platforms and our weapons against the targets in the scenario; a TACWAR model, which is used by the Army and the Joint Staff. This is a deterministic model which is often used to model ground force activity. And then the Thunder model used by the Air Force for air campaign work. We used all three models to be sure there were not significant differences in results and to use the best features of each to get a very thorough look at the situation.

Senator NUNN. Mr. Chairman, I just want to underline one point on that assumption. To me that is not an extremist assumption that you have made. It is an unrealistic assumption but it is not extreme. The extreme assumption would be if you did not have fighter aircraft in there protecting the non-stealthy bombers. The extreme assumption would be if a chemical attack had closed the bases and you could not get tactical air in there. That is the worst case assumption, but I do not think that is an unrealistic assumption on some scenarios in the next 20 years.

So, I would really question severely your statement that that is an extreme assumption. I do not see that as an extreme assumption. That is kind of a best case assumption where you can basically say that there is no tactical air, but tactical air is all over the place allowing us to fully deploy and fly the non-stealthy force.

Dr. KAMINSKI. It would require, Senator Nunn, in this case more simply than closing down the bases. We would also have to close down any escorts that could come from a carrier, and if we had no escorts from either a carrier or from a local base, then the figures that I showed here would even be more robust; that is, we would not be talking about 60 additional B–2s. We would probably be talking about a few hundred additional B–2s because of constraints on using the B–1s and the B–52s in the arrangement. So, it really comes down to how pessimistic we want to be in terms of removing forces from the situation.

What I in earnest tried to do in that situation was be very pessimistic in assuming that I have no carrier aircraft available for 15 days, no strike aircraft available either in the theater or that could arrive in the theater in 15 days, and I did, as you correctly point out, allow for a wing's worth of air superiority aircraft to be there.

Senator NUNN. Well, what happens to all of this if you do not have any bases open for air superiority aircraft?

Dr. KAMINSKI. It depends on whether I have any carriers available.

Senator NUNN. Let us assume you do not have either. We did not have carriers available for a number of days in the recent Iraq——

Dr. KAMINSKI. If I do not have any carriers available for 15 days, and I do not have any tactical aircraft in-theater, and I do not have any means to get tactical aircraft in-theater, and we have to continue with this MRC scenario, then I am going to need a lot more bombers than I have in the current force.

Senator NUNN. And you are going to need a lot more stealthy bombers, are you not?

Dr. KAMINSKI. It is a combination of stealthy bombers and standoff weapons.

Senator NUNN. I just want everybody to kind of understand that these study assumptions drive the results. I think we have to focus on the assumptions because if you figure there is no place in the world we are going to fight where we do not have access to enough bases to have immediate protection for the non-stealthy bombers, if you assume that is never going to happen, that is to me a very rosy scenario. It may be true. I do not know, but to me it is kind of doubtful looking down the road.

Senator LOTT. While you are hesitating, does anybody else want to jump in?

Senator INHOFE. Yes, I do.

Senator LOTT. All right, go ahead because I think it is a very important point.

Senator INHOFE. Mr. Chairman it is kind of a coincidence that I was wondering the same thing as Senator Nunn. As I looked over the list of assumptions, I was wondering if I do not have the bases that are out there, I do not have the carrier support for a non-stealthy bomber out there, how are we going to do it? I think by making those assumptions—I came to this meeting trying to get an answer to that, as to whether these assumptions are realistic. I still have not heard that they are.

Dr. KAMINSKI. I do not believe these assumptions are realistic, Senator. I believe that certainly one can construct situations in which they would be realistic, but for the two-MRC scenario we are looking at, I believe we will have carriers that we can rely on. I believe we will have tactical air forces in the theater to start with, and I believe that we will have tactical air that can arrive in the theater, and that we ought to be using all of those forces rather than simply be depending upon our bombers. We have paid for all those forces, and those ought to be forces that we allow to be brought to bear in our assessment.

Senator INHOFE. So, assuming we have the carrier support, base support, then that would be adequate for the non-stealthy bombers. On the other hand, if we did not, it would not.

Dr. KAMINSKI. If we did not have any of that support, then we would have to buy a lot more bombers than we would be thinking about buying.

Senator LOTT. Senator Hutchison.

Senator HUTCHISON. Yes. I would like to just add another question in the area of assumptions, and that is, is it true that in your assumptions you were relying on B–52s up until the year 2030?

Dr. KAMINSKI. Correct, we are.

Senator HUTCHISON. 65 years old? You are relying on 65-year old planes as part of our——

Dr. KAMINSKI. Yes, we are. Our assessment is that the B–52s can be used till the year 2030.

Senator HUTCHISON. Do you think that is a good assumption?

Dr. KAMINSKI. I do. I might ask General Loh to comment.

Senator HUTCHISON. I would love for General Loh to comment.

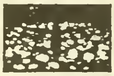
Senator LOTT. I think that is a very critical question, but maybe we could go ahead and let him complete his statement. I would like for him to do it as soon as he could and to hear from General Loh, and we will come right back to that question. It is the crux of the whole problem.

But maybe you can defend yourself a little more here, Dr. Kaminski. Please proceed.

Dr. KAMINSKI. Thank you, sir.

Bomber Force

Total Aircraft Inventory – 2014

Option	 B-52	 B-1	 B-2	 TOTAL
Planned Force	66	95	20*	181
Retire B-1s	94	0	20*	114
Buy 20 More B-2s, Retire B-1s	94	0	40*	134
Buy 20 More B-2s	66	95	40*	201

* Does Not Include One Test Aircraft

Chart 10

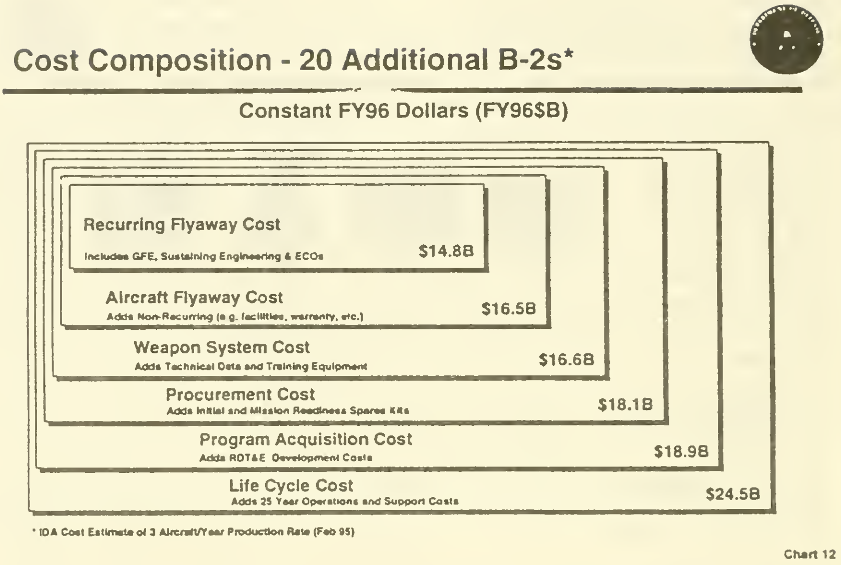
In the baseline case, using all of our planned forces, we looked at four differently composed bomber forces. The first row shows our planned force, 66 B–52s, 95 B–1s, 20 B–2s, for a total of 181 in the year 2014. As I said earlier, we did this analysis for three different time frames, 1998, 2006, and 2014. I will show you most results for the year 2014 because at various rates of additional B–2 production, we do not see all of the B–2s in the force in the earlier years. So, I wanted to use a year in which all the data were there. If you want to see the earlier years, I have that as well.

The next force looked at retiring the B–1s, adding back some number of B–52s to compensate, making 94 B–52s, 0 B–1s, 20 B–2s, for a total of 114.

The third force, in which we retired all of our B–1s to produce resources to pay for additional B–2s, led to a total bomber force of 134 aircraft.

And the fourth force in which we simply kept the planned bomber force and added to it 20 additional B–2s for a total of 201 bomber aircraft.

We looked at each of these forces in our baseline case.



Cost Composition - 20 Additional B-2s*

Constant FY96 Dollars (FY96$B)

Recurring Flyaway Cost	Includes GFE, Sustaining Engineering & ECOs	$14.8B
Aircraft Flyaway Cost	Adds Non-Recurring (e.g. facilities, warranty, etc.)	$16.5B
Weapon System Cost	Adds Technical Data and Training Equipment	$16.6B
Procurement Cost	Adds Initial and Mission Readiness Spares Kits	$18.1B
Program Acquisition Cost	Adds RDT&E Development Costs	$18.9B
Life Cycle Cost	Adds 25 Year Operations and Support Costs	$24.5B

* IDA Cost Estimate of 3 Aircraft/Year Production Rate (Feb 95)

Chart 12

Now, the issue of cost of the additional 20 B–2s. Costs get reported in so many different ways. What I presented here is a way that puts together all the different terms used for costs, so you have a whole picture.

Starting with the recurring flyaway cost, which includes the purchase of the aircraft, government furnished equipment, sustaining engineering and engineering change orders (ECO's), goes all the way down the line building up to the various components of a program until we get to the total program acquisition cost which is $18.9 billion.

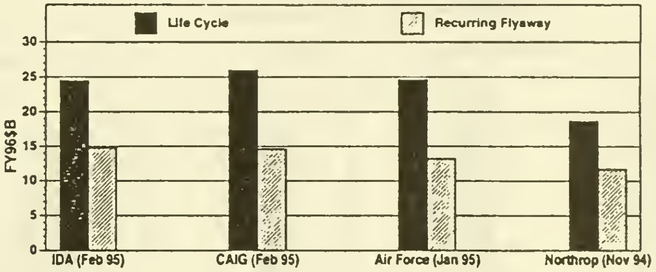
Incidentally, all of these numbers are in constant 1996 dollars.

And then the final number on the chart, which is the life cycle cost, which takes the acquisition cost and adds 25 years operations and support costs. So, purchasing and operating the additional 20 B–2s costs $24.5 billion in 1996 dollars.

There is one other number here that has been discussed in the press as well. That is taking that life cycle cost data and putting it in then-year inflated dollars, in which case that $24.5 billion turns into $30.8 billion.

Now, if you remember that $24.5 billion, I will go to the next chart.

Cost Comparisons - 20 Additional B-2s*



* Cost Estimate Comparisons of 3 Aircraft/Year Production Rate

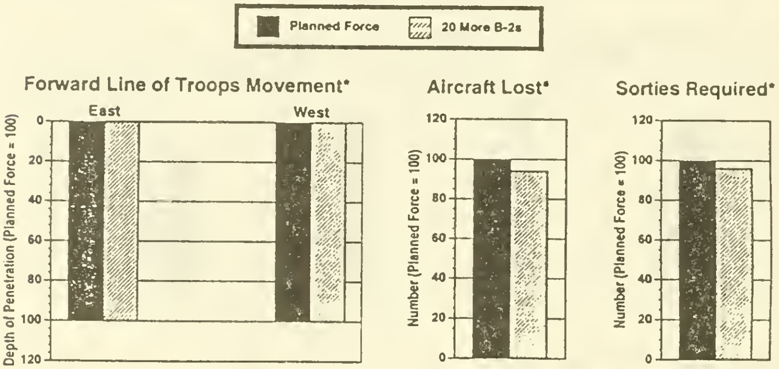
Chart 13

Different people who do cost analysis get different results, and I wanted to show you a comparison of these results. The $24.5 billion that I just described is the blue bar on the left. It is the cost analysis done by the Institute for Defense Analyses. The shorter bar is the flyaway piece of the cost. It does not include the life cycle cost or the other elements that I reported. Our OSD Cost Analysis Improvement Group (CAIG) also did an estimate and those two bars are shown, a slightly higher estimate for the life cycle cost. The Air Force also did an estimate, very close to the IDA estimate, and on the far right we have the estimate by Northrop which is somewhat lower. It is lower because it does not include some of the things in the government estimate such as sustaining engineering, engineering change orders, and warranties. It is also based on a different learning curve.

The cost data that I used in all the rest of the Cost and Operational Effective Analyses (COEA) that I am going to present is based on using the IDA data on the left.

Measures of Effectiveness

Baseline Case - 2014



* Depth of Enemy Penetration, Aircraft Lost and Sorties Required During Both Major Regional Contingencies (100 = Normalized Value Under Baseline Conditions in 2014)

Chart 14

Now, here is the first set of results for this baseline case in the year 2014. On the left, the first output measure, the movement of the forward line of troops. The blue bar shows the depth of penetration of the forward line of troops for the baseline case. Since the actual number is classified, I have set this number at 100 to give you a yardstick as a frame of reference.

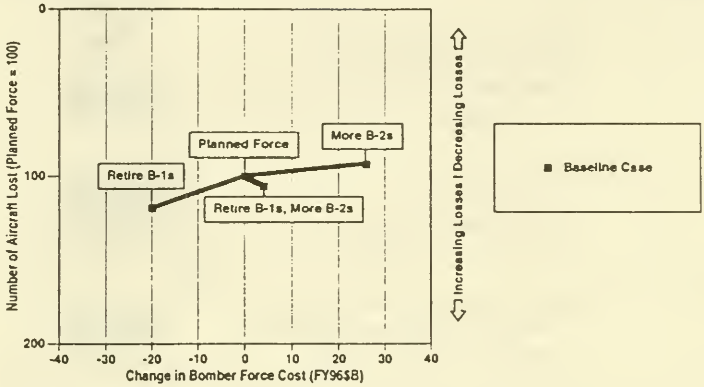
The bar on the right, the hatched bar, now shows what happens in the MRC East when we add 20 more B–2s to the force. The difference is extremely small. You cannot really see it on this chart.

The same situation prevails in MRC West.

The next measure of performance is the number of aircraft lost in conducting the campaigns in the two-MRC scenarios. With a baseline bomber force—again we have arbitrarily set that at 100—that is 100 percent of the aircraft that were lost. Adding 20 additional B–2s improves the situation and we do lose fewer aircraft. Our losses are about 7 percent less as a result of the addition of the 20 B–2s to the force.

The third measure is the number of sorties required to complete the campaign. Again, the baseline is set at 100 percent. We see that adding 20 B–2s reduces the number of sorties that are required to do the job by about 5 percent.

Cost Effectiveness



* Aircraft Lost by US and Allied Forces During Both Major Regional Contingencies (100 = Normalized Number of Total Aircraft Lost Under Baseline Conditions in 2014 with the Planned Bomber Force)

Chart 15

Let me turn from these numbers now to a cost effectiveness plot. The way I have done this plot I show the change in bomber force cost along the bottom and the number 0 goes with our planned bomber force. So, the planned bomber force by definition has 0 change in cost, and the number of aircraft lost, using this normalizing yardstick, was 100 percent of what we had in the campaign.

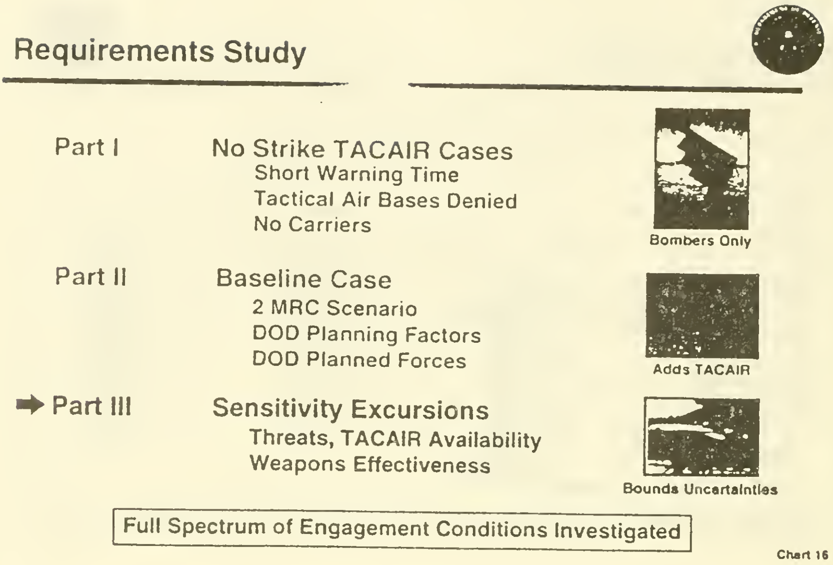
Now, to look at the first excursion, we see what the impact is of buying 20 additional B–2s. That is an added cost of $24.5 billion, as I had shown you in the cost analysis, and the impact is that we lose 7 percent fewer aircraft in the combined two-MRC situation.

I cannot make an objective judgment about cost effectiveness here. You have to make a subjective judgment at this point.

The next excursion looks at retiring all of our B–1s. That ends up saving with the retiring of the B–1s and the addition of a small number of B–52s, then that is a savings of about $20 billion. So, it is lower in cost by that amount, but it results in 20 percent more aircraft lost in the two-MRC scenario. So, we are seeing the penalty for removing bombers from the force.

The third excursion there is the combined excursion in which we retire all the B–1s and use the savings derived from the B–1s to purchase 20 additional B–2s. You see the savings is not quite enough because the cost increases by about $4.5 billion. So, it costs us additional money, but we see that we also come out worse. We spend more money and we lose about 7 percent more aircraft. So, that is clearly not a cost effective thing to do. We do not want to retire the B–1s and use that funding to buy additional B–2s.

This is a summary of the baseline case.



Requirements Study

Part I — No Strike TACAIR Cases
- Short Warning Time
- Tactical Air Bases Denied
- No Carriers

Bombers Only

Part II — Baseline Case
- 2 MRC Scenario
- DOD Planning Factors
- DOD Planned Forces

Adds TACAIR

➡ Part III — Sensitivity Excursions
- Threats, TACAIR Availability
- Weapons Effectiveness

Bounds Uncertainties

Full Spectrum of Engagement Conditions Investigated

Chart 16

What I want to do now is go into a bigger set of excursions in which we look at variations in warning times and availability of tactical air and the effectiveness of our weapons.

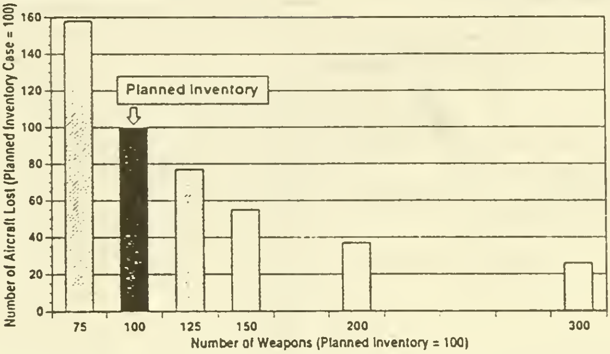
Senator NUNN. On that "tactical air bases denied," the same question. Does that mean denied completely or does that mean denied only strike aircraft?

Dr. KAMINSKI. The denial of tactical air in that situation, Senator Nunn, is based on the presumption of chemical attacks on the bases, and in the first week of operation, we deny 67 percent of the sorties that would normally be launched from the bases. In the second week of operation, we deny half, and in the third week, I believe we deny a third. So, that does not treat strike aircraft or air superiority aircraft any differently.

Senator NUNN. So, that is a different set of assumptions in there.

Dr. KAMINSKI. A different set of assumptions.

Weapons Excursion*



* Aircraft Lost by US and Allied Forces During Both Major Regional Contingencies vs Accurate Guided Weapons Inventory (100 = Normalized Value of Total Aircraft Lost Under Baseline Conditions in 2014 with the Planned Bomber Force and Weapons Inventory)

Additional Weapons Reduce Aircraft Losses

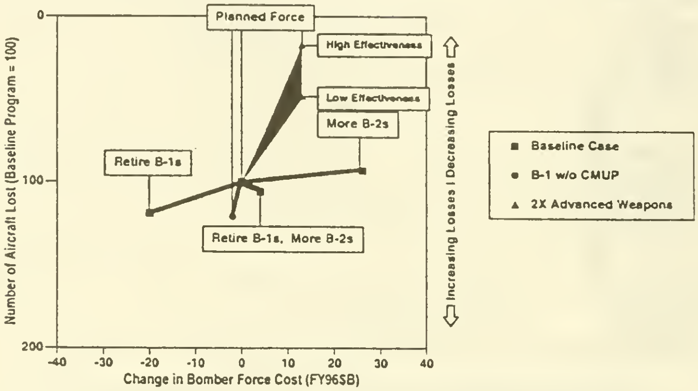
Chart 18

Let us go to the next chart. The first excursion that we did from the baseline case was to look at the impact of weapons in the inventory, and using my yardstick approach, the blue bar goes with our planned inventory of weapons. It is 100 percent of what we plan to buy. And the number of aircraft lost is by definition 100 percent.

If we reduce our planned purchase of weapons and buy only 75 percent of what is in our plan, the number of aircraft lost goes up almost 60 percent over the baseline. So, the weapons have a big impact on the outcome and on our losses.

If we go the other direction and double the number of weapons that we buy—that is, go to 200 percent of our planned inventory—we see that the number of aircraft lost drops by more than 60 percent over what we had in the baseline case. What this shows is the weapons here have a big impact on aircraft losses, and they also have a big impact on the outcome of the two-MRCs.

Modernization Sensitivities



* Aircraft Lost by US and Allied Forces During Both Major Regional Contingencies (100 = Normalized Number of Total Aircraft Lost Under Baseline Conditions in 2014 with the Planned Bomber Force)

Chart 19

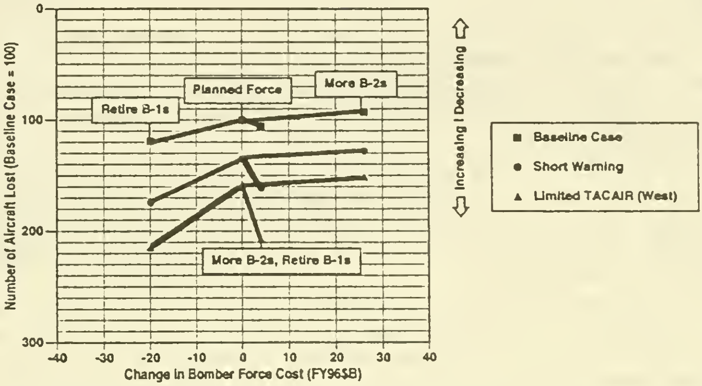
Now, let me plot that back in this cost effectiveness format that I showed you earlier. The blue curves on this line were the ones that I just explained for the baseline case. You see the baseline force, the impact of adding more B–2s, and the impact of retiring the B–1s.

The green curve on this chart plots what I just described in terms of the impact of weapons. If the weapons are low in effectiveness, you are the bottom of the curve. If the weapons are high in effectiveness, you tend to be on the higher end of the curve.

What that fan shows, if we just pick the middle point for a comparison, is that by spending an additional $13 billion or $14 billion to double our weapons inventory, we reduce the number of aircraft lost by about 60 percent. Now I can make an objective comparison of cost-effectiveness and conclude that that is a much more cost effective expenditure than buying additional B–2s. We can see for $13 billion we have a much bigger impact on aircraft lost than we do in spending $24.5 billion for 20 additional B–2s.

There is one other point on this curve. It is the red line. Included in our baseline program is a conventional mission upgrade for the B–1. If we do not do that conventional mission upgrade, we save about $2 billion (we move to the left), but we also end up losing about 22–25 percent more aircraft than we did in the baseline. So, that is not a cost effective thing to drop; that is, we should keep our conventional upgrade to the B–1 in place because you can see the slope of that line is nearly equal to the slope of the weapons line, and the slope of both of those lines is better than the slope of the B–2 line in terms of the added benefit for the cost involved.

Scenario Sensitivities



* Aircraft Lost by US and Allied Forces During Both Major Regional Contingencies (100 = Normalized Number of Total Aircraft Lost Under Baseline Conditions in 2014 with the Planned Bomber Force)

Chart 20

Let me now go to variations associated with warning time and availability of tactical air. The blue line on this plot is the same one that I described in the earlier scenarios. There has been a lot of discussion in this scenario about warning time. Did we use excessive warning time in all of our assumptions?

So, I took a case here in red shown as short warning time. In this situation, we had 0 tactical warning time; that is, we did not let our forces deploy until the actual attack began. So, this is what I would describe as a no tactical warning time situation. It is an extreme case on the warning time perspective.

You see the outcome of that is the drop in the planned force from blue to red showing that because of the absence of this warning time, we lose about 30 percent additional aircraft over the baseline case. So, this warning time indeed has a significant impact on the outcome. We see again that adding additional B–2s helps, but not in an extremely significant way. It adds back about 5 percent. It reduces losses by about 5 percent.

Retiring the B–1s has an even bigger effect here. What we are starting to see here is under these very stressful scenarios, that we would like to have more of a bomber force; that is, giving up the B–1s is making a difference and we should not give up those additional 95 aircraft. That slope is starting to decrease and having a more significant effect on the outcome.

We have gone now even to a more severe excursion in which we have kept the case of no tactical warning, and then we have limited the TACAIR in our Southwest Asia situation in the way I just described, assuming chemical attacks on the bases. We denied all the local sorties, reduced them down to one-third of their normal amount, removed two-thirds for the first week, removed a half for the second week, and removed a third for the third week of the engagement.

You can see again that our overall losses increase with the planned force. They are now 70 percent worse than they were in the planned case. Adding additional B–2s helps again only by a small amount. Retiring all the B–1s now costs even a more significant impact.

Senator LOTT. Excuse me for the interruption, but we have needed to do that a couple of times.

You say it is not a significant difference. What is the difference between the green line and the blue line? On that chart it is pretty narrow, but what are——

Dr. KAMINSKI. There is a big difference between the green line and the blue line, Senator Lott, and the difference between the green line and the blue line is the difference between the baseline and that which happens with 0 tactical warning and unavailability of TACAIR from local bases.

The B–2 is in the same place on each of those charts, though. So, if you are wanting to compare what the B–2 does to the baseline, what you have to do is look at the difference between the planned force and the baseline in each case.

So, what I was concluding is that the B–2 adds something in each case, but the addition does not change very much from scenario to scenario.

Senator LOTT. Excuse me for the interruption, but please move forward rapidly too.

Conclusions

The planned force can meet the national security requirements of two nearly simultaneous major regional contingencies (MRCs) for anticipated scenarios and reasonable excursions

Additional quantities of accurate guided munitions shown to be more cost effective than procuring 20 additional B-2s for baseline 2 MRC scenario and reasonable excursions (further study required to determine best weapons mix)

The planned bomber force with accurate guided munitions provides a prudent hedge against excursions from the baseline scenario

Planned conventional upgrades to B-1 bomber force shown to be more cost effective than procuring additional B-2s

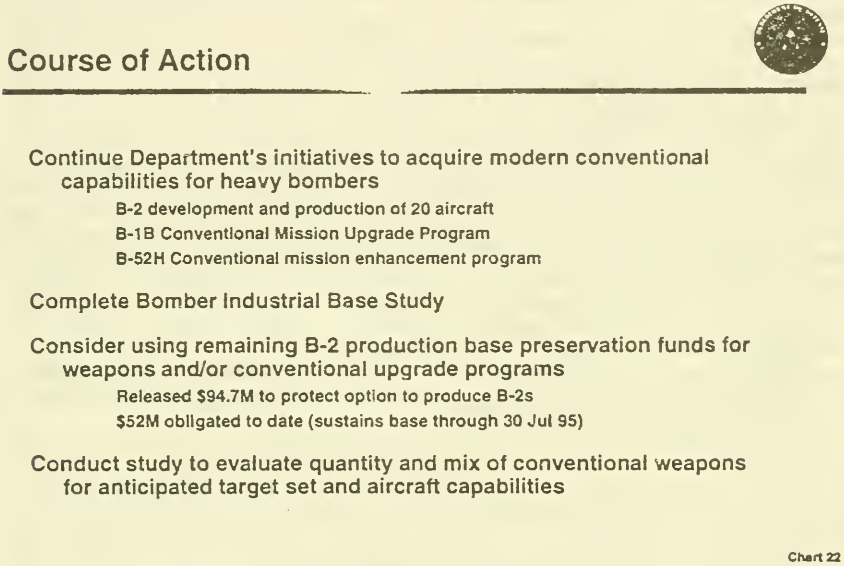
Chart 21

Dr. KAMINSKI. The conclusions that I draw from this assessment is that the planned force can meet our national security requirements for two nearly simultaneous MRCs for the anticipated scenarios and the reasonable excursions that have done to go with them.

That additional quantities of precision guided munitions are shown to be more cost effective than buying 20 additional B–2s for again the same baseline two-MRC scenarios and reasonable excursions. And this has such an important effect, such an important outcome that we believe more attention is required to look at the best mix of these weapons rather than simply doubling the number we bought as we did in this analysis. Weapons have a high payoff and we need to look carefully at this.

The third point is that the planned bomber force with precision guided munitions provides a prudent hedge against the excursions. You could see that as we gave up additional B–1s, the slope of that line was not something one would want to have under those excursion conditions involving no tactical warning or unavailability of bases due to chemical munitions attacks.

And the fourth point is that our planned conventional upgrades to the B–1 bomber force were shown to be more cost effective than procuring additional B–2s.



Course of Action

- Continue Department's initiatives to acquire modern conventional capabilities for heavy bombers
  - B-2 development and production of 20 aircraft
  - B-1B Conventional Mission Upgrade Program
  - B-52H Conventional mission enhancement program
- Complete Bomber Industrial Base Study
- Consider using remaining B-2 production base preservation funds for weapons and/or conventional upgrade programs
  - Released $94.7M to protect option to produce B-2s
  - $52M obligated to date (sustains base through 30 Jul 95)
- Conduct study to evaluate quantity and mix of conventional weapons for anticipated target set and aircraft capabilities

Chart 22

In terms of a way ahead, we believe we should continue the Department's initiatives to acquire modern conventional capabilities for our heavy bombers. That includes completing our development and production of 20 B–2s, doing the conventional mission upgrade program on both the B–1B and on the B–52H.

We need to complete the industrial base study required by the Congress for us to make a recommendation on what to do with the bomber industrial base.

And we need to consider best use of the funds that were established for maintaining the B–2 production base. We certainly will not move on those funds until such time as reported back to you on the results of our industrial base study.

Last because of the significant impact of our weapons, we need to conduct a separate assessment to evaluate the quantity and the mix of conventional weapons for anticipated target sets and aircraft capabilities and do a follow-on effort in this arena.

That concludes my statement, Senator Lott.

[The prepared statements of Dr. Kaminski and Dr. Koleszar follow:]

Prepared Statement by Paul G. Kaminski, Under Secretary of Defense for Acquisition and Technology

BOMBER MODERNIZATION

Mr. Chairman, Members of the subcommittee, and staff, thank you for the opportunity to appear before you today to discuss the specifics of the Department's bomber modernization strategy. My first involvement with long range bomber force issues dates back to 1977 when I worked as special assistant to then Under Secretary of Defense William Perry. I was involved in establishing the framework for the stealth programs, to include what eventually became the F–117 and the B–2. In 1981, I was reassigned to be director of low observables technology, at which time the F–117 was entering production, and source selection for the B–2 was being completed. For me, Mr. Chairman, heavy bomber studies, employment of stealth technology and the B–2 bomber are familiar landmarks along a path I first traveled down nearly 20 years ago.

Our heavy bomber force, composed of the B–52H, B–1B, and B–2, is a very important element of America's total military power. Used in conjunction with other formidable elements of military force, or alone in some cases, our heavy bombers can project America's presence around the world in peacetime and project responsive force in times of armed conflict.

For the last 50 years, U.S. bomber aircraft were acquired and equipped primarily to perform the long-range, penetrating mission in response to all-out nuclear war. For many of those years heavy bombers provided the manned portion of the well known and successful triad deterrent concept. The postulated threat of that time, the former Soviet Union, possessed awesome military defenses that required an incessant drive to develop and quickly field the latest offensive and defensive systems. Because of the importance and seriousness of the nuclear mission, and the lower probability of a conventional conflict, our bombers were provided with the capability to perform the conventional warfare mission as a secondary role. However, the world has dramatically changed in recent years and we believe that we are now more likely to use our heavy bombers in a conventional conflict in some region of the world far from our shores, facing a well armed, but somewhat less formidable foe than our previous adversary.

Our heavy bombers possess the characteristics of speed, long-range, and large payloads which are well suited to provide an immediate response to hostile action by some ill-meaning despot. Therefore, in recent years we have redirected our bomber programs to reflect a higher conventional requirement and devised upgrade programs to maximize our previous investments, comply with treaty requirements, and yet, still retain the capability to respond to a nuclear attack if needed. Based upon intelligence community projections, our planning for future conflict situations has included the stressing scenario in which one adversary chooses to invade the sovereign territory of one of our allies, and some short time later a second adversary chooses to attack a second ally in another region of the world. That case was cited and supported in the fiscal years Bottom-Up Review and Defense Planning Guidance, and named therein as the two nearly-simultaneous major regional conflicts scenario.

To provide a framework for assessment, we requested the acquisition and operational communities of the Joint Staff and the services to define our existing and planned bomber force conventional capabilities, and what would be the best use those capabilities should we find ourselves involved in a future conflict scenario involving two nearly-simultaneous major regional contingencies. We challenged the intelligence community to project what capabilities our most likely adversaries would possess in future years of 1998, 2006, and 2014. Based upon all that information, we have analyzed the capability of our planned bomber force to meet the national security requirements of fighting two nearly-simultaneous major regional conflicts. Because we know our ability to accurately project the future is less than perfect, we also analyzed alternatives to our planned bomber force, and evaluated numerous excursions to changes in warning times, threat, force arrival projections, weapons inventories, weapons effectiveness, and various other key parameters.

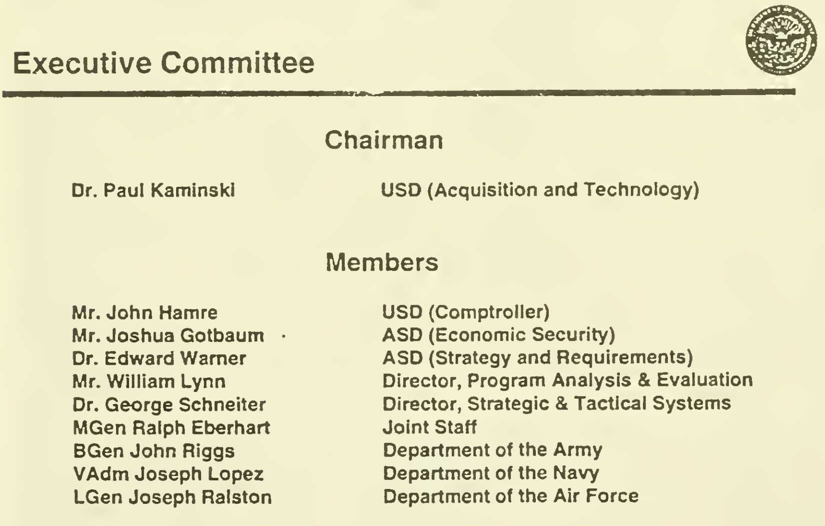
FISCAL YEAR 1995 HEAVY BOMBER FORCE STUDY

The analysis I am referring to is known as the fiscal year 1995 Heavy Bomber Force Study. I would like to provide you with a summary of the results of this major analytical work. I believe this is the most significant and comprehensive study to date that considered the use of all three heavy bombers in the conventional warfighting role in conjunction with other United States and Allied ground, naval, and air forces. I believe that an accurate summary can be presented in unclassified form, but the details of the study must remain classified and be protected because the data used in the conduct of the study was obtained from actual war planning documents. Only in a classified forum can I adequately convey the full scope, magnitude, and significance of this study. I believe the fiscal year 1995 Heavy Bomber Force Study will become the intellectual cornerstone for building our bomber forces for the next century.

Charts 1 through 22 convey the results of the study. Chart 2 summarizes the congressional direction. Language contained in both the Fiscal Year 1995 Authorization Act and in the Appropriations Act requested the Department to analyze bomber program costs and requirements for the scenario of two nearly-simultaneous major regional contingencies in the years 1998, 2006, and 2014.

In response to these requests, the Department initiated an Fiscal Year 1995 Heavy Bomber Study plan composed of three separate sub-studies as depicted in the logic flow diagram on chart 3. Let me, at this point, give you a four-point bottom line:

- First, we have completed the first sub-study, the bomber requirements study. The results of that study do not make the case for buying additional B–2s.
- Second, this is the most comprehensive study of bomber force structure that I have ever been associated with in about 17 years of working in this arena. Chart 4 identifies the members of the executive committee who guided this effort. The study included all the relevant forces that would be involved in a future two major regional contingency (2MRC) scenario; and all the planning assumptions that the Department uses to size the Bottom-Up Review forces and that the Department is currently using in defense planning guidance. These are the same underpinnings as we have used to size the rest of the Department's force structure and programs.



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MGen Ralph Eberhart	Joint Staff
BGen John Riggs	Department of the Army
VAdm Joseph Lopez	Department of the Navy
LGen Joseph Ralston	Department of the Air Force

Chart 4

- Third, our study shows the overwhelming importance that tactical air forces play in this 2MRC scenario; and the fact that one can not ignore the impact of tactical air forces in making bomber force structure decisions as have many other studies in the past. The key point to be made here is being sure that one has tested the major assumptions and the uncertainties associated with employment of tactical airpower. This includes where and how tactical air (TACAIR) arrives, how fast it arrives, and the potential for constraints on TACAIR bases. We've worked in earnest to illuminate those issues.

- Fourth, the study shows that additional value is provided by more B–2s. But what it also illuminates is the much greater cost effectiveness that can be derived from procuring greater quantities of advanced accurate guided weapons to leverage not only the bombers, but the rest of our tactical forces. Additionally, bomber conventional upgrades that we looked at in the study are clearly cost-effective and necessary.

I will go through these conclusions in some detail to support the underlying points. As a consequence, we are not recommending buying additional bomber capability and are now on the path labeled "No" on the chart 3 logic diagram. We still have one more piece of this overall effort to complete, because as I indicated earlier, with the decision "No", we do need to complete a Bomber Industrial Base Study. That effort is already in progress and we expect to complete that effort in early July 1995. Following the completion of this sub-study, we can then decide what we need to do with our underlying industrial base if we're not buying additional B–2s. For example, what specific industrial capabilities need to be preserved?

As shown in chart 5, I will present the results of the bomber requirements study in three parts. The first part is what I call "No strike TACAIR." This is a very extreme excursion case, but it was one that we used to relate the results of this study with the other bomber studies that did not include the use of tactical air forces. The next two parts of the results presentation are really the heart of what we did. Part two examines the baseline case of a 2MRC scenario with all of our planning factors and all of our planned forces included in the campaign. Then part three addresses all the sensitivity excursions. It examines variations in assumptions and planning factors that one would want to undertake to be prudent in looking at hedge positions, and exploring alternatives to be looked at. In parts two and three together, we examined what I believe to be a full spectrum of engagement conditions.

Most of the results presented in this statement will be for the year 2014, the most interesting case. We obtained similar results in other years (1998, 2006), but the effect of 20 additional B–2 is greatest in this year because of the fact that they all in the force by this time. Our estimated useful life for the B–52H aircraft goes through the year 2030. The long service life of the B–52H aircraft is attributed to the just recently completed engine replacement program and the projected use of the airframe in a relatively benign, medium-to-high altitude flight regime.

NO STRIKE TACAIR CASES

We looked at two major regional contingencies, designated "East" and "West," in which strike tactical air forces were arbitrarily constrained to be not available for employment during the first 15 days of each contingency. There could be a variety of reasons, or combinations of events, that could preclude use of strike tactical aircraft. For example, there could be continuing enemy attacks on all of our airfields; no carrier aircraft available; or basing restrictions for political reasons. In this extreme case, the strike assets available to us are only the long range bombers during the initial 15 days of the war in each contingency. We are getting a little bit of air superiority support, but no strike missions from tactical air forces.

Chart 6 presents the results of this "No Strike TACAIR" case. This chart depicts the normalized maximum extent of enemy penetration into allied territory during the initial "halting" phase of the "East" and "West" major regional contingencies. The actual movement of the forward line of troops is classified, so I have displayed a normalizing yardstick to be able to give you a basis for comparison. The normalizing benchmark number on this yardstick is 100, in the sense that 100 percent represents the maximum penetration into allied lines during the baseline case in which tactical air forces are present during the opening phase of each contingency.

In chart 6, the first solid bar represents this baseline case for each of the two contingencies. With our planned bomber force only, including all 20 B–2s, the next striped bar indicates that we lost 50 and 80 percent more territory in the opening phase of "East" and "West" contingencies respectively. After the first 15 days, tactical aircraft were gradually inserted into the strike order of battle. We then added 20 more B–2s to the planned bomber force and ran the "No Strike TACAIR" scenario again. This time, the amount of territory lost was down to about 40 and 70 percent more than that lost during the baseline case. We re-ran this case with 40 more and 60 more B–2 bombers as well. In each case, we lost slightly less territory during the halting phase of each major regional contingency.

When one looks at the "East" MRC, you can see that it takes a little more than 60 additional bombers to hold the line of troop movement to near what we had when we used tactical air and bombers together in the baseline case. I must be careful here to note that the additional bombers would not be a complete substitute for the strike tactical aircraft because those tactical aircraft are used to prosecute the war to conclusion, including offensive operations, following the 15 day restriction. However, one can conclude that additional bombers do provide an important hedge against additional territorial losses should tactical aircraft not be available, for whatever the reason, during the early days of a conflict. In this study, we looked at other excursions that restricted the use of tactical aircraft for shorter periods of time and different rates of arrival in theater.

There are three overall observations, listed on Chart 7, that I would make from the "No Strike TACAIR" cases. The first is that one can not ignore the contribution of tactical air forces in an MRC. The second is that up to 60 more B–2s would not fully compensate for an 8–15 day denial of strike tactical air capability. And third, additional B–2s certainly helped to mitigate the absence of strike tactical aircraft. This result is similar to the results of other bomber studies that have been done without including planned tactical air forces. One can observe that we are moving back in the right direction and reducing the movement of the forward line of troops. But one needs a significant number of bombers to make up this difference. Not shown on the chart is the fact that we would need significant increases in accurate munitions if we used additional bombers to do this job, and those bombers have to be forward based to allow sufficient number of sorties.

BASELINE CASE

Mr. Chairman, I would like now to present the results of the baseline case (see chart 8): two major regional contingencies using the Department's planned bomber force and tactical air forces, along with the planning factors that go with them. This case, along with many excursion cases, were evaluated by the Institute for Defense Analysis (IDA) using the campaign analysis methodology depicted in chart 9.

The major inputs to the campaign level models used by IDA were the projected threat, the planned forces and the planning scenario provided by the Department of Defense. The threat, in the form of air defenses and ground forces, was derived from estimates made by the Defense Intelligence Agency (DIA) and the national security intelligence community and then confirmed by the national intelligence officer for general purpose forces. The forces used were those in the Department's Future Years Defense Program (FYDP) and Defense Planning Program (DPP). These forces were confirmed and reviewed by the executive committee, identified earlier in chart 4, and composed of senior representatives of the services, Joint Staff, and the Office of the Secretary of Defense (OSD). The two near-simultaneous MRC scenario was based upon the planning factors consistent with those used by the Department to establish the Bottom-Up Review force structure. It reflects the current planning guidance for the Department's future budget activity.

IDA used three different campaign models to perform the analysis: the IDA Bomber Force Model, TACWAR and THUNDER. Each model possessed a high amount of fidelity in one or more areas. For example, the IDA Bomber Force Model makes use of linear programming techniques to optimize the assignments of weapons to targets in order to minimize losses. TACWAR is a campaign level model used by the Army, the Joint Staff, and a wide variety of planners within the defense community. It is a deterministic model with unique strengths in simulating ground warfare outcomes. THUNDER, a model developed by the Air Force, uses stochastic techniques to model the scenario and assess air campaigns. The IDA study team emphasized the strengths of each model and looked for consistency of the output results. This procedure mitigated the possibility of obtaining results biased by the characteristic of a particular model. Many other bomber studies tend to rely on only one type of model.

These models are tremendously large and require the input of many tens of thousands of input variables—forces, capabilities, weather, terrain, threats, tactics, weapons effectiveness, and the like. In turn, these models produce results in the form of a number of outcome measures. During the course of the study, we examined those outcome measures and further evaluated those that influence the overall campaign outcome. Today, I will present results in terms of three outcome measures. The first one is the movement of the forward line of troops. I showed you that measure earlier in chart 6 during my discussion of the "No Strike TACAIR" cases. The next is the total number of aircraft lost during the individual combat missions of both MRCs. The third outcome measure is how many sorties were required to successfully complete the campaign.

This was the study approach to assess bomber force requirements. As I testified earlier, this is the most comprehensive study, that I personally have been involved with—about 12 man-years and $3 million have gone into this IDA effort since November of last year. As a part of this effort, IDA performed a systematic analysis of 18 other related studies that have been published on this subject. This analysis provided useful insights into the robustness of the assumptions, conclusions, and recommendations of this and the other studies.

Chart 10 illustrates the range of bomber force structure options evaluated during this study for the year 2014. The effectiveness of each of these bomber force options was evaluated at the three different years specified in the congressional language: 1998, 2006 and 2014. These years, although mandated, were reasonable choices for evaluating near-, mid- and long-term bomber force effectiveness. The force composition varies a slight amount over time as new bombers are built and introduced. By 2014, the options containing 20 more B–2s have reached full operational force levels.

The first option is the planned total force of 181 bombers. The second option the B–1s from the planned force. To compensate some for loss of capability, this option also adds 28 B–52s for a total force of 114 bombers. This is a lower cost option than our planned force because the money saved from retiring 95 B–1s is considerably greater than what we would spend to restore 28 B–52s. The third option is a near constant life cycle cost case where the B–1s are retired to buy 20 more B–2s. The fourth option is the most expensive. This option adds 20 more B–2s to the planned force.

One of the key scenario planning factors was the arrival of bomber and tactical aircraft at forward bases. Chart 11 depicts the time phased arrival of bombers and tactical aircraft into each of the two MRCs. Although the heavy bombers carry a larger weapons load, this chart clearly illustrates my earlier point about how the employment of tactical aircraft dominates the U.S./allied air-to-ground strike campaign.

Arrival of Air Forces

Baseline Case - Two MRCs 2014

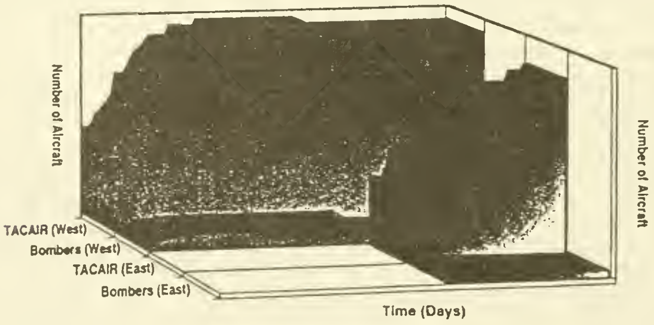


Chart 11

Chart 12 provides a comprehensive summary of the life cycle costs associated with procuring and operating an additional 20 B–2 aircraft. It starts with the recurring flyaway cost of each B–2 aircraft. And then, certain non-recurring costs like facilities and warranties are added to yield aircraft flyaway cost. Next, weapon system cost is determined by including technical data and training equipment to the cost estimate. Procurement cost brings initial and mission readiness spares into the estimate. Program acquisition cost adds and amortizes the development costs. Finally, life cycle costs include the support costs associated with operating the 20 additional B–2s over a period of 25 years.

During this study, all cost comparisons were made in terms of constant fiscal year 1996 dollars—a standard practice for making investment decisions. As a point of reference, if we took the IDA life cycle cost estimate of $24.5 billion and converted it to then year dollars, this amount would inflate to the Air Force's previously reported estimate of $30.8 billion for 20 more B–2s. Chart 13 presents constant fiscal year

1996 dollar comparisons of the recurring flyaway and life cycle cost estimates made by IDA, the OSD Cost Analysis Improvement Group (CAIG), the Air Force, and Northrop for 20 additional B–2 bombers. This chart shows, not surprisingly, that different costing groups sometimes get different results. The IDA estimate compares well with the two government estimates. There is a difference with the Northrop estimate. The difference is attributed to a number of items that are not included by Northrop, but were included in the government estimates such warranties, sustaining engineering, engineering change orders, and mission readiness spares. There was also a difference in learning curve projections for production of aircraft.

Chart 14 presents some normalized results for the baseline case. Three different measures of effectiveness (MOEs) are shown in this chart—forward line of troops movement, aircraft lost and sorties required. Each measure is the aggregate total associated with the campaign in both MRCs. Again, the results are normalized on the basis of 100 for the planned force to make the results presentable in an unclassified forum.

The first MOE, forward line of troops (FLOT) movement, portrays the minimum depth of penetration by enemy forces into allied lines. One wants a small depth of penetration. So a shorter bar is better on this chart. In this comparison, the results obtained with the planned bomber force are compared to the case where 20 more B–2s are added to the planned force. The resulting difference in FLOT movement is small and difficult to discriminate for both the "East" and "West" MRCs. In terms of this measure, the change in the size of the bomber force represented by 20 additional B–2s just does not change FLOT movement in a significant way when all the other tactical forces are also at play in the scenario.

The next measure of effectiveness is total number of bomber and tactical aircraft lost during the campaign, or attrition. This is an important measure because as attrition increases you have less resources to use against the enemy and the conflict will become more costly and prolonged. In chart 14, a shorter bar means a smaller number of losses. In comparison to the planned force, a force with 20 additional B–2s lost 6 percent fewer aircraft.

The third important measure presented in chart 14 is the number of sorties required to complete the two MRC campaign. This is a measure of efficiency and depends not only upon the platform used, but the weapon employed against the target When compared to the planned force, a total force with 20 more B–2s required 4 percent fewer sorties. Again, this is a slightly better result.

The differences are small because the bomber force changes are small when compared to the total number of tactical aircraft available to strike enemy targets. The available number of combat aircraft includes: all the allied aircraft that are already in the theater, U.S. aircraft that were already in the theater at day one, plus the U.S. tactical aircraft that are deployed to the theater. In excursions where the number of strike missions flown by tactical aircraft are restricted, particularly in the early phases of the conflict, some discrimination begins to appear with the addition of 20 more B–2 bombers to the planned force. However, it comes down to the point I made earlier: tactical air forces have a big impact on the campaign outcomes. If one examines these results in detail, bombers are far more important during the early halt phase as tactical air forces are arriving. Once all the tactical air forces are in place and fully employed—the bomber contribution shrinks to a small portion of the overall aggregate force.

The relative cost-effectiveness of the bomber force options were evaluated by combining the life cycle cost estimates with the measures of effectiveness results. Chart 15 plots the normalized number of aircraft lost as a function of change in bomber force cost. Again, to keep the results unclassified, the number of aircraft lost is set to 100 for the planned force option. Cost changes are expressed relative to the planned force option as well. On this chart, movement toward the upper left hand quadrant coincides with fewer aircraft losses and less cost-a more cost effective result.

It is important to emphasize that every one of the bomber force options on chart 15 satisfied the requirements of the two MRC scenario—every enemy target was serviced with a prescribed level of damage. Since each of the bomber force options were sufficient to meet mission needs, cost-effectiveness becomes the primary factor in selecting the best value bomber force option.

An examination of the relative cost-effectiveness of the 20 more B–2s option reveals that the cost increase by $24.8 billion and 6 percent fewer aircraft were lost. On the other end of the cost spectrum, one could retire all 94 B–1s and restore 28 B–52Hs at a savings of $20 billion—the requirements of the two MRC scenario are still met—but 18 percent more aircraft are lost during the course of the two MRC campaign.

The option that retires the 94 B–1s, restores 28 B–52Hs and uses the savings to buy 20 more B–2s provides an opportunity to make an objective statement of cost effectiveness. This option, relative to the planned force, costs more and ends up with a greater number of aircraft losses. This is clearly an option one wants to remove from further consideration. In addition, this example examines the results in 2014. This option is also less attractive from an implementation viewpoint: 94 B–1s would be retired in the near term—along with an attendant loss of combat capability—while 20 B—2s are added to the inventory over 20 years.

SENSITIVITY EXCURSIONS

Excursions to the baseline case were run to examine reasonable variations in our predictions of the threat, availability of tactical air forces, and in the effectiveness of weapons (see chart 16). The full spectrum of underlying engagement conditions shown in chart 17-including weather, threat level, warning time, use of special operations forces, chemical attacks on tactical aircraft bases, and several others—were examined during this portion of the study. These cases tested the sensitivity of our assumptions and helped us get to the basis of another important issue. Do we need bombers at all?

Bomber Study Conditions

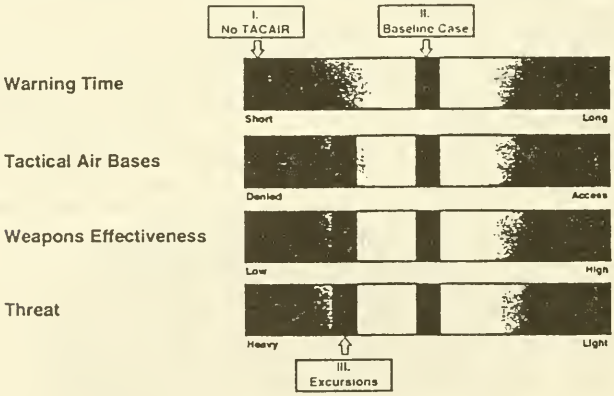


Chart 17

Chart 18 depicts the results with respect to the inventory of advanced accurate guided weapons. Once again I am using a normalizing yardstick where 100 is the planned weapons inventory case. Using this planned inventory of weapons, we set the number of aircraft lost to 100 percent. This chart shows a nearly 60 percent increase in the number of aircraft lost during the campaign for a 25 percent reduction in planned weapons inventory levels. If, on the other hand, we double the planned inventory of advanced accurate weapons, the number of aircraft lost falls to a level that is a little less than 40 percent of the planned inventory case. The quantity of accurate guided weapons inventories have a dramatic impact on the outcome of the scenario. This is not surprising, because the weapons are not only leveraging the bombers, they are leveraging all the tactical aircraft as well.

There are weapons that can be used on ships or fired by land. We, for example, have a few thousand Tomahawks in the planned force and those are used in the baseline case. We also have missiles that are operated by the Army, including the MLRS and ATACMS systems. All of these systems were used in the baseline assessment. The results of this weapons excursion were based upon changes in the number of air-delivered weapons only.

Chart 19 conveys the relative cost effectiveness of doubling the buy of advanced accurate munitions and the B–1 Conventional Munitions Upgrade Program (CMUP). A two-fold increase in the current weapon inventory objective will cost approximately $13 billion. For this investment, there is between a 50 and 80 percent reduction in the number of aircraft lost from the baseline program case. The relative slope of the weapons excursion case on chart 19 clearly show a much greater reduction in aircraft losses per dollar spent than we obtain buying additional B–2s. I can now make an objective judgment that buying more weapons is more cost effective than buying 20 additional B–2s

I would also note that relative to other studies, our overall assumption was reasonably conservative about weapons effectiveness. For this reason, we performed excursions with more and less effectiveness than our conservative estimate. This additional excursion in effectiveness accounts for the "fan" plotted in chart 19. This sensitivity is so high that it turns out to be one of the most important outcomes in the study. We plan to more carefully investigate the weapons composition rather than simply doubling the current inventory.

Chart 19 illustrates the answer to another issue: the relative cost effectiveness of the decision to proceed with the B–1 conventional mission upgrade program. This program is well defined and costs about $3 billion, which is approved and programmed in our planning and budget documents. It is part of the planned force. So we did an excursion to evaluate the cost-effectiveness of canceling this planned program. By removing it, we would save $3 billion, but we would end up losing about 20 percent more aircraft. That is clearly not a good move. The B–1 CMUP appears to be just as effective as procuring additional weapons. Our plans were well funded and this is something we will want to continue.

Chart 20 presents some sensitivities to scenario conditions. The upper most curve represents the baseline case, followed by a short warning case and then followed by a limited TACAIR case. The short warning case reduces the warning time to zero in one of the major regional contingencies. As a result, tactical aircraft arrive much later than under the base case. There is an overall increase in the number of aircraft lost in for each of the bomber force options evaluated. This is the cost of not being able to recognize what an adversary is about to do. We make every reasonable effort to anticipate what our enemies are planning to do, but 100 percent knowledge of what another is planning is not possible. In this case, there is about a 35 percent increase in the number of aircraft lost. Retiring the B–1s actually has a larger detrimental effect under this reduced warning scenario. That is, one can see the slope of the line is changing and becoming a steeper.

The most severe scenario shown in chart 20 is the case where the employment of strike tactical aircraft was limited to loss of more than half of the tactical air sortie rate for the first week, and something like half the normal sortie rate for the next week as a result of attacks on bases. In this case, we incur further losses, about 60 percent more, than we had in the baseline. The same trend continues: retiring B–1s has a greater detrimental effect. Although none of these excursions are planned, they do point to the need for bombers as a prudent hedge against adverse scenarios.

The sensitivity analyses bounded the robustness of the bomber force options and the validity of assumptions. This effort was one of the unique strengths of the IDA study—many contemporary bomber studies analyzed a base case scenario and conducted few or no excursions to test for changes in key assumptions.

CONCLUSIONS

Mr. Chairman, I draw the following four conclusions (see chart 21):

- One, the planned force can meet the national security requirements of two nearly simultaneous major regional contingencies (MRCs) for anticipated scenarios and postulated excursions.
- Two, additional quantities of accurate guided munitions would be more cost effective than procuring 20 additional B–2s for the baseline two MRC conventional scenario and postulated excursions (further study is required to determine the quantity and best weapons mix).
- Three, the planned bomber force with accurate guided munitions provides a prudent hedge against excursions from the baseline scenario.
- Four, planned conventional upgrades to the B–1 are more cost effective than procuring an additional 20 B–2s for meeting the requirements of the two MRC scenario and postulated excursions.

The results of the bomber requirements study argue favorably and soundly for continuing the Department's initiatives to acquire modern conventional capabilities for the heavy bomber force (see chart 22). Those initiatives include continuing development and production of 20 B–2 aircraft, the B–1 conventional mission upgrade program, and the B–52H conventional mission enhancement program.

Because the bomber requirements study concludes that our planned forces with 20 B–2 aircraft are sufficient for the anticipated scenarios, I plan to re-evaluate the decision to allocate funds for preserving the B–2 production base. Those funds may be used more effectively by reallocating them to needed weapons, or bomber conventional upgrade programs. We will continue the ongoing bomber industrial base study, and I will not make any final decision on reallocating B–2 production base preservation funds until I receive the results of that study by July 1.

I plan to initiate a study to further evaluate both the quantity and mix of accurate guided weapons needed to meet the requirements of the two MRC scenario and reasonable excursions. We will evaluate the weapons requirement for the total planned force to successfully attack the anticipated target set and operating within the postulated threat environment.

SUMMARY

In closing I would like to thank the Chairman, and Members of the committee for this opportunity to convey the results of our recent Heavy Bomber Force Study and our plans for modernization our bomber force. I believe the heavy bomber force, although small in number, is one of the most highly leveraged force options in America's arsenal. We plan to vigorously pursue the necessary conventional upgrades to meet the challenging requirements of maintaining the peace and projecting our national will with military power when called upon to do so.

[Charts not appearing in Dr. Kaminski's prepared statement can be found elsewhere in his oral testimony.]

Prepared Statement by Dr. George E. Koleszar

Mr. Chairman and members of the committee, thank you for the opportunity to present the results of the cost-effectiveness analysis of alternative bomber forces done by the Institute for Defense Analyses (IDA).

The Institute for Defense Analyses is a not-for-profit Federally Funded Research and Development Center (FFRDC) that provides independent and objective studies and analyses for the Office of the Secretary of Defense, the Joint Chiefs of Staff, the Defense agencies, and the Commanders in Chief of the U.S. unified commands. The Department of Defense requires from IDA high-quality research and advice with unquestioned objectivity, free from conflicts of interest.

Now let me turn attention to the work IDA did to support the fiscal year 1995 Heavy Bomber Force Study.

In response to congressional direction, the Office of the Secretary of Defense (OSD) tasked the Institute for Defense Analyses to conduct a cost-effectiveness analysis of alternative bomber forces. The National Defense Authorization Act for Fiscal Year 1995 specified that the analysis be done using scenarios involving two nearly-simultaneous major regional contingencies (MRCs) in the years 1998, 2006 and 2014. OSD selected five alternative bomber forces for comparison. The cost of these forces and the capabilities they provide were the subject of the IDA analysis.

BOMBER FORCES ANALYZED

Force	B–52s	B–1Bs	B–2s	Total
Planned Force	66	95	21	182
Increase B–52s	94	95	21	210
Retire B–1s	94	0	21	115
Buy 20 B–2s, Retire B–1s	94	0	41	135
Buy 20 B–2s for Planned Force	66	95	41	202

IDA used the DOD Defense Planning Guidance scenarios for the two-MRC analysis. The Joint Staff and the services provided force arrival information and aircraft apportionment and sortie allocation data based on current war plans. The analysis was done using three different force-level (campaign) computer models: a bomber force model developed by IDA, the TACWAR model used by the Joint Staff and CINCs, and THUNDER, a detailed Air Force campaign model. Threat projections were provided by the Defense Intelligence Agency and reviewed by the Intelligence Community. The effects of variations in scenario conditions, threat capabilities, and other key parameters were examined in extensive sensitivity analyses.

Some of the excursions analyzed included shortened warning times, delayed U.S. force arrivals, availability of tactical aircraft, an increased threat beyond what the intelligence community projects, an improved B–2 bomber, degraded weather (which would affect the delivery of laser guided bombs), no JAST aircraft in 2014 (in the event that program is delayed), reduced electronic countermeasures effectiveness, and cases where more bombers are based closer to the conflict area. IDA choose to run so many excursions because of the uncertainties associated with using future planning factors and the fact that other studies assumed such a wide range of conditions in their analyses.

Several critical factors influenced the outcome of the analysis. With regard to U.S. force capabilities, significant numbers of Air Force and Navy tactical aircraft arrive early in the conflict and account for the vast majority of strike sorties flown against enemy targets. Over the period 1998–2014, continued planned modernization of the tactical aircraft force, including the introduction of new low-observable aircraft such as the F–22 and Joint Advanced Strike Technology aircraft, resulted in a very capable mixed strike force of bombers and tactical aircraft. In addition, a growing inventory of advanced accurate munitions such as the Joint Direct Attack Munition, Joint Standoff Weapon, Wind Corrected Munitions Dispenser with Sensor-Fused Weapon, and a replacement for the recently canceled TriService Standoff Attack Missile, all contributed to an airpower posture growing in lethality and kill efficiency.

With regard to potential enemies covered in the study, the Intelligence Community estimates continued—but slow—modernization over the period of 1998–2014. Ground force capability will expand but air defense system modernization, requiring significant financial investment on the part of a nation, will grow more slowly.

As a result of our cost-effectiveness analysis; the following are the study findings:

- Bombers make important contributions to U.S. combat performance over a wide range of scenario conditions examined in the study. The contributions are greatest during the early phases of conflict before other U.S. forces are deployed fully. To realize the full potential of programmed bomber forces, both B–1Bs (through the ongoing Conventional Mission Upgrade Program), and B–2s should be upgraded to improve their conventional combat capabilities.
- Buying 20 more B–2s would provide a modest increase in overall U.S. force effectiveness under DOD's current, two-MRC planning scenario, but would cost an additional $25 billion (fiscal year 1996 dollars) over the next 25 years. The relative contributions of additional B–2s would increase under more severe scenario conditions, involving shorter warning times and/or other restrictions on the availability of U.S. tactical aircraft and other forces.
- Retiring the existing 95 B–1Bs would save about $20 billion over the next 25 years but would reduce force effectiveness appreciably. As the severity of the restrictions on tactical aircraft increases, the effects of losing the B–1B force become more pronounced. Retiring all B–1Bs and buying 20 more B–2s was found to be less cost-effective than the planned force in virtually all cases examined. The capabilities provided by the 20 additional B–2s would not offset fully the loss of the larger B–1B force, outfitted with advanced weapons and improved electronic countermeasures for self-defense.
- Procuring additional advanced munitions would provide a greater increase in force effectiveness than buying more B–2 bombers for the two-MRC scenario, and it would cost less.

Mr. Chairman, the information contained in my opening statement is general in nature. The vast majority of IDA's work on the Heavy Bomber Force Study was, of necessity, classified. If the subcommittee chooses, I have prepared a short classified briefing that summarizes the results of our work and can present that to you in closed session.

Thank you again for allowing me to comment on IDA's work.

Senator LOTT. General Loh, if you would go ahead with your statement and then we will ask both of you questions.

STATEMENT OF GEN. JOHN M. LOH, USAF, COMMANDER, AIR COMBAT COMMAND

General LOH. Yes, sir. Thank you, Mr. Chairman, for the opportunity to be here today.

As the Commander of Air Combat Command, my responsibility is to provide the bulk of our combat air power to our unified warfighting commanders and with the fewer in-place forces, they need immediate and overwhelming power from the United States when they face a major regional aggressor, and our long-range bombers armed with conventional weapons can meet that need efficiently and effectively.

Though our forces overseas have drawn down dramatically, our need for global influence and presence appears to be growing. In addition, the conditions facing our forces are radically different today. We are now a much smaller and a home-based force without the forward deployed units and infrastructure we depended on so heavily in the past.

In addition, the proliferation of weapons of mass destruction, theater ballistic missiles, and deadly air defenses complicates our security equation, and when we decide to commit U.S. forces, you expect us to accomplish our objectives quickly and decisively, win quickly with overwhelming advantage and with few casualties. Therefore, the first 2 or 3 weeks of a conflict are extremely important because if we do not get a leg up and start to dominate early on, then we find ourselves in a defensive posture and having to overcome an enemy's advantage.

So, this new environment presents a tremendous challenge for our home-based force and demands that we place global presence and immediate global power projection at the core of our new national security strategy. This strategy depends on long-range air power, especially when we are called into action with little or no warning. Our Nation's bomber force with its immediacy, its global range, massive precision fire power, and stealth gives us unmatched flexibility to respond to the full spectrum of national security challenges.

No other weapons system can project American power as efficiently and as effectively. And yet, I think our bomber force is undervalued by many observers due to outdated Cold War perceptions. Our bombers are still our most flexible nuclear deterrent but their value to our Nation goes far beyond this limited role. When we arm with advanced conventional weapons, their inherent capabilities make them a powerful deterrent to conventional aggression and the ideal centerpiece of our power projection strategy. In the critical early hours of a major regional conflict, our bombers can launch from the United States to blunt the advance of any aggressor and buy time to deploy a winning joint force. With the combination of stealth and advanced munitions, our bombers can decimate advancing armor divisions, attack the enemy's command and control and air defense systems, and neutralize the weapons of mass destruction that hold the deployment of our follow-on forces at risk. During sustained operations, our bombers can then deploy forward to accelerate the tempo of theater operations, and their combination of stealth and multiple precision weapons makes them tremendous force multipliers. In the opening days of a conflict, the B–2 can launch standoff weapons against critically important, high threat targets as it did during the early hours of the Gulf war.

The B–1, when upgraded to deliver precise conventional weapons will be our work horse. It will be able to strike with standoff precision weapons or use its speed, electronic countermeasures, and nap-of-the-earth flying to penetrate some enemy defenses, and attack a wide variety of critical medium threat targets. In addition, the B–1 will integrate easily into composite strike packages with fighters and defense suppression aircraft to attack more heavily defended targets.

The successful B–1 operational readiness assessment proved that the B–1 can sustain combat operations if we give it adequate funding for logistic support. We should give all of our B–1 squadrons the support to bring them up to the readiness level established for a mature bomber, and we have budgeted for that in our budgets.

Most of all we need to leverage our investment in the B–1 by funding the conventional upgrades and electronic countermeasures that will allow our B–1s to reach their full potential, and again those are funded in our budgets.

The leading edge of our bomber force is the B–2. The B–2s revolutionary capability—underline "revolutionary"—places the full spectrum of potential targets at risk and its advance stealth allows us to attack covertly if necessary. In the opening days of a major conflict, the B–2 can decimate advancing ground forces and penetrate enemy air defenses to attack weapons of mass destruction and other highly defended targets. By attacking sophisticated air defenses, the B–2 will also enhance the effectiveness of our other bombers and follow-on attack forces.

Bombers also offer significant new options in cases short of all-out war. With stealth and precision weapons our bombers can deter or preempt terrorists by holding their bases of operation at risk, and they may allow us to counter the threat of theater ballistic missiles at the lowest cost with their offensive capabilities to strike these missiles before they are ever launched. The capability to attack virtually any target within 24 hours with stealth, precision, and minimal risk to American lives constitutes a new and more economical form of continuous global presence.

With this kind of unmatched capability, it is important that we have an adequate bomber force. Our analysis confirms that we will need 100 operational bombers. We will need to operate 100 operational bombers in peacetime to provide an aggressive and powerful response to a single major regional aggressor. Should we find ourselves in a second nearly simultaneous conflict, we will be forced to swing a portion of our bomber force, at least 50 percent of our bomber force, from the first conflict to the second.

Moreover, the Nuclear Posture Review calls on us to maintain a nuclear force of 20 B–2s and at least 66 B–52s. So, to provide sufficient numbers of bombers for our nuclear mission and meet our conventional requirements, in my opinion we need about 184 bombers for combat and training alone, and the Bottom-Up Review agreed with that number.

With 184 bombers, the necessary conventional upgrades, and advanced munitions, we can execute the swing strategy and maintain a credible nuclear deterrent reserve. Yet, we should keep in mind that this swing strategy is untried and could stretch our combat forces' strategic lift and logistic support very thin. If we are unable to swing bombers in the two-MRC scenario, we will not have enough bombers to deploy 100 to each MRC.

Not only must we maintain the bombers we have, we must preserve our capacity to produce bombers for the long term. We have invested heavily in stealth and in manufacturing technologies for stealth that are unique to bombers. So, our bomber industrial base is a national asset and we must find a way to preserve it.

To get the most from our investment in bombers, we must equip them with advanced precision weapons, like the joint direct attack munitions, the sensor fused munitions, and the wind corrected munitions dispenser. To meet our long-term need for standoff capability, we must push development of the joint standoff weapon and find an affordable replacement for the tri-service standoff attack missile.

Bombers are our most efficient and effective means of projecting American power and presence around the world. A smart combination of upgrades, advanced weapons, and new aircraft will make our bomber force a formidable deterrent to all forms of aggression and the centerpiece of our power projection strategy.

That concludes my opening statement, sir. I would just like to underscore the fact that this is a very important subject that we are undertaking here, a critically important subject and at a critical time. I believe that it requires careful deliberation.

Thank you.

[The prepared statement of General Loh follows:]

PREPARED STATEMENT BY GEN, JOHN M. LOH, USAF, COMMANDER, AIR COMBAT COMMAND

Mr. Chairman and Members of the committee, thank you for the opportunity to discuss our Nation's bomber force, the centerpiece of our offensive global power projection strategy.

Airpower has proven, many times over, its vital importance to this Nation, perhaps never more vividly than during the Persian Gulf war. And even as we enjoy so-called "peaceful" years, the options offered by land-based airpower for bombers in particular have never been more useful to us, and the need to nurture a strong and capable Air Force never more compelling.

As the commander of Air Combat Command, it is my responsibility to organize, train, and equip the Air Force's U.S.-based combat air forces to meet any possible aggressor. I provide the vast majority of the combat airpower our unified commanders depend on in their theater operations. Our commanders recognize that, with few in-place forces, they will need immediate and massive firepower from the Continental United States should they face a major regional aggressor; in their war plans, they insist that our long-range, conventionally-armed bombers answer this call.

The security environment has become far less predictable, and we face unprecedented threats to our national interests. Though our forces overseas have shrunk dramatically, our need for global influence and presence appears to be growing.

We are now a much smaller, primarily home-based force, without the sizable forward-deployed units and support infrastructure that we relied on so heavily in the past. This new environment has altered our strategy for protecting our security interests, and demands that we place global presence and immediate global power projection at the core of our new national strategy.

Such a strategy depends on long-range airpower—especially when we are called into action with little or no warning. Our Nation's bomber force, with its combination of immediacy, global range, massive precision firepower, and stealth, gives us the operational flexibility to respond to the full spectrum of national security challenges—from nuclear deterrence and major regional conflict to global terrorism. No other weapon system can hold at risk all the targets this nation deems critical, nor project power as effectively and efficiently. Our bomber force is truly a national asset and a key instrument of U.S. power.

And yet, I think our bomber force is undervalued. Perhaps this is due to old perceptions of our bombers as Cold War relics suited only for delivery of nuclear bombs. Though our bombers are still the most flexible leg of our nuclear deterrent force, they long ago moved beyond such a limited role. When rearmed with advanced conventional weapons, their inherent capabilities make them a tremendous deterrent to conventional aggression as well, and the ideal centerpiece of our new power projection strategy.

Our bombers are always ready. At the opening of a short-notice, major regional conflict, our bombers—with a combination of standoff and direct attack munitions—can launch from the United States within the first few hours to blunt the armored advance of any aggressor and buy time to deploy a winning joint force. With stealth, our bombers can penetrate deadly air defenses to attack weapons of mass destruction that hold our deployment at risk. When upgraded with advanced conventional munitions, our bombers will be able to decimate the enemy's advancing divisions, paralyze his command and control system, and cripple his air defenses. To ensure the deployment of our follow-on forces, all of this must happen quickly; our bombers deliver this kind of immediate combat power—efficiently and effectively.

During sustained operations, our bombers can deploy forward to accelerate our operational tempo, and they integrate easily into theater air operations. Their combination of stealth, precision, and multiple weapons makes them valuable force multipliers, and they add enormous firepower to our composite strike packages.

Bombers also offer significant new options in cases short of all-out war. For example, with immediate global reach and precision conventional weapons, our bombers can deter or preempt terrorists by holding their bases of operation at risk. And during hostilities, the United States may be able to counter the threat of theater ballistic missiles—most efficiently—with an offensive capability to target them before they are ever launched.

Today, our bomber squadrons—soon to include our B–2 squadrons—routinely demonstrate this kind of visible power projection on their "global power" training missions. Our crews fly non-stop from the United States to strike targets on bombing ranges in Asia, Europe, and the Middle East, demonstrating their power projection capability to our friends and potential adversaries alike. For example, as Iraqi forces retreated from the Kuwaiti border last fall, Air Combat Command B–1s and B–52s flew to the Gulf and dropped 55,000 pounds of live ordnance on a bombing range in Kuwait—a powerful demonstration that was not lost on Iraq.

These global power missions do several things: they demonstrate our global reach; they put a formidable, cost-effective American presence in regions in which we may no longer have permanent forces; they give our crews valuable training in the missions they would fly in the opening hours of a major conflict; and they desensitize our allies to the use of bombers as a long-range conventional weapon. Last year, our bombers completed five overseas deployments and flew 34 global power missions in support of 11 JCS and 8 other exercises. This year our exercise participation will be even greater.

We have three bombers in our Nation's inventory, the B–52H, B–1B, and the B–2. Each of them, when properly upgraded to deliver advanced conventional weapons with precision, will make a significant contribution during crisis and conflict.

The B–52H delivers both nuclear and conventional weapons. In the opening days of a major conflict, the B–52H can launch standoff weapons against critically impart and, high threat targets as it did during the early hours of the Gulf war. Once we reduce the air defense threat, our B–52s can penetrate to attack ground forces and other large targets using low-cost, direct-attack munitions on a massive, economic scale.

The B–1, when upgraded to deliver accurate conventional munitions, will be the backbone and workhorse of our bomber force. In the first days of war, the B–1 will be able to strike with standoff precision weapons, or use its speed, electronic countermeasures, and nap-of-the-earth flying to penetrate medium-threat enemy defenses and attack a wide variety of critical targets. In addition, the B–1—with its great speed and firepower—can integrate easily into composite strike packages with fighters and defense suppression aircraft to attack more heavily-defended targets.

The successful B–1 Operational Readiness Assessment (ORA) proved that the B–1 is as sustainable as any other mature aircraft given adequate funding for manpower and spare parts. The results of the 6-month test speak for themselves—the test unit's 84 percent mission capable rate far exceeded ORA standards. We also generated savings in support costs by improving parts distribution and repair times.

The B–1 should receive the support that will give the entire B–1 fleet the mission capable rate established for a mature bomber—75 percent. And most of all, we need to leverage our investment in the B–1 by funding the conventional upgrades and electronic countermeasures for all 95 B–1s that will allow the fleet to reach its full potential. I ask for your support for these improvements.

Our bombers' unique capabilities put them at the center of our national power projection. At the leading edge of our bomber force is the B–2.

The B–2 is one of the few systems in our history that has the capacity to define a new strategy. Its revolutionary capability places the full spectrum of potential targets at risk, and the B–2s advanced stealth allows it to attack covertly, if necessary. In the opening days of a major conflict, it can penetrate enemy air defenses to attack the enemy's advancing divisions and most heavily-defended strategic targets, such as his weapons of mass destruction, with precise direct attack munitions. By attacking sophisticated air defenses, the B–2 also enhances the operational effectiveness of our other bombers and follow-on attack forces.

In addition, this capability to strike virtually any target within 24 hours—at minimal risk to American lives—constitutes a new, and more economical, form of continuous global presence.

Our B–2s at Whiteman Air Force Base are performing very well during their first year in the field. During our last Red Flag training exercise, B–2s delivered live 2,000 pound bombs—at night, from high altitude, and with expected accuracy.

But I am concerned that we may not have enough bombers to meet all of our operational demands. Our analysis tells us that we will need 100 deployable bombers in the initial days of a major conflict to provide an aggressive and powerful response to an enemy offensive. Should a second major conflict arise during the first MRC, we will have to swing a portion of our bomber force from the first conflict to the second.

Moreover, last September the Nuclear Posture Review defined our requirement to maintain a nuclear force of 20 B–2s and at least 66 B–52s. To provide sufficient bombers for our nuclear mission and to meet our conventional requirements, our analysis shows we need about 180 bombers. The Bottom-Up Review agreed with that number.

With 180 bombers and the necessary conventional upgrades, the swing strategy will be less stressing, therefore less risky, and we will be able to maintain a viable nuclear deterrent reserve; yet, we should keep in mind that this strategy is untried, and could stretch our combat forces, strategic lift, and logistics capability very thin. If we are unable to swing bombers in the two MRC scenario, we will not have enough bombers to deploy 100 to each MRC. So it is important that we maintain sufficient numbers of bombers for the long term.

Not only must we maintain the bombers we have, we must preserve our capacity to produce bombers for the long term. We have invested heavily in technologies based on stealth and modern manufacturing techniques that are unique to bombers. Our bomber industrial base is a national asset—we must find a way to preserve it.

To get the most from our investment in bombers we must equip them with advanced precision weapons. The Joint Direct Attack Munition (JDAM) will give us strike capability in any weather; the Sensor Fused Weapon (SFW) will allow our bombers to destroy enemy armor more efficiently; and the Wind Corrected Munitions Dispenser (WCMD) will allow our bombers to employ accurate anti-armor weapons from medium and high altitudes above air defense artillery fire.

To meet our long-term need for standoff weapons capability, we must push development of the Joint Standoff Weapon (JSOW) and find an affordable replacement for the Tri-Service Standoff Attack Missile (TSSAM). JSOW will give us standoff capability against armored forces, and a TSSAM replacement will give us long-range standoff against hardened, fixed targets.

Bombers are our most efficient and effective means of projecting American power and presence anywhere on the globe. With a smart combination of aircraft upgrades, advanced weapons, and new aircraft, we can make our bomber force a formidable deterrent to all types of aggression and the centerpiece of our global power projection strategy.

In closing, I would like to thank the Members of the committee for your long-standing support of our Nation's defense, and request your continued, future support for airpower adequate to meet our defense needs in an uncertain world.

Thank you.

Senator LOTT. Since we do have several Senators here, we will try to limit it to 5 minutes. I know that may be difficult. We will be starting with that and we will get a second round. I know all of us have a lot of questions. We will continue until we get through with the questions we need to ask.

General Loh, it seems that bombers made no contribution to the so-called halting phase of conflict in the Desert Storm war. Why did bombers play so small a role in that war?

General LOH. Well, the bombers were the first aircraft to attack targets deep over Iraq on the first night of the war with B–52s launching conventional air-launch cruise missiles. So, they were effective in hitting some of the strategic targets on the first night, along with the F–117s and their stealth capability. So, I believe the B–52s early on made an initial contribution.

And then, of course, the B–52 cannot penetrate defenses until they are completely suppressed. So, their contribution then had to wait until we achieved total air superiority and suppressed all of the enemy defenses, and then they could be brought back into action in areas that were permissive, that allowed them to drop massive amounts of fire power on particularly the Republican Guards of the Iraqi forces. And in that case, they were very effective. They were most effective in being able to draw down the combat power of the Iraqi forces' raid against us.

Senator LOTT. So, the assumption then that they did not make a significant contribution to the halting phase is wrong.

General LOH. Well, I am not sure what you mean by "halting phase." The Iraqis stopped their advance short of going into Saudi Arabia and stopped there. So, then when we attacked, we were able to drive them out of Kuwait. So, there was no real halting phase in and of itself. I think the bombers did make a significant contribution to the overall outcome, however.

Senator LOTT. Let me go ahead with other questions.

Now, you went through how many bombers you are going to need. For one of these regional conflicts, you would have to have 100 operational bombers. If you had a second one, you would go with a swing concept, but you note that that has never really been done.

What are the numbers if you have the two simultaneous? Would you have to have—you said, what, 184?

General LOH. The Air Force Bomber Road Map that we published a few years ago and the Bottom-Up Review confirmed the need, if you could afford them, of up to 184 bombers for combat and training. I think that is a good number because then we could send 100 bombers to the first MRC, maintain some back in the States in reserve for either deterring further aggression with either conventional or nuclear weapons, but then if we were engaged in a second MRC that was nearly simultaneous, we would still be forced to send some bombers from the first war to the second war. That is the so-called swing strategy.

There is good news and there is bad news there. The good news is that bombers do have the capacity to be able to swing rapidly halfway around the world and be used in two regional conflicts.

Senator LOTT. Well, my question is, do you really think that is practical?

General LOH. Well, the more you depend on a swing strategy, the more risk you entail in your security planning. So, I have signed up to the swing strategy in terms of providing those forces, but I think it is going to be difficult because we are talking about crews that have already been exercised in one war and we are talking about being able to swing rapidly from one part of the world to another while the rest of the logistics system is being stressed in trying to deploy forces to that second MRC. So, it adds some risk to being able to win that second MRC rapidly. Therefore, we would like not to have to depend on it, Mr. Chairman.

Senator LOTT. And it also is contingent on having 66 B–52s. Is that right?

General LOH. Well, our current force structure has a total of 56 B–52s. We have funded for operation and maintenance 56 of those.

Senator LOTT. 56.

General LOH. I use 12 of those for training. So, I can deploy today in fiscal 1996 with the 1996 budget 44 B–52s to a major MRC. I would hold 12 back for continued training, and then there are 10 that would be in depot status or test status or some other non-operational status. That is the way we count aircraft and it is the standard way of counting them for any conventional force.

Senator LOTT. General Loh, the B–1 has obviously labored under a cloud with low readiness of force. However, the Congress has required a realistic assessment of the requirements to bring the B–1 up to standards. I understand that assessment and analysis has been completed. What is your impression of that assessment and the B–1s future?

General LOH. Yes, sir. The Congress directed, you directed, us to conduct a 6-month operational readiness assessment of the B–1 wherein we supplied one wing of B–1s with its full complement of air crews and ground crews and spares and support equipment, and we demonstrated that given normal logistic support, we could more than beat the in-commission rate, the mission-capable rate, that is expected of a mature bomber.

We achieved an 84 percent mission-capable rate. We did that by a lot of process improvements and a lot of smart moving of parts around. We have been able to maintain those same kind of mission-capable rates since the end of the operational readiness assessment.

I believe this demonstrated once and for all that the B–1, if adequately funded, can perform up to its expectations. It cannot perform as well as the B–2 because it does not have the stealth characteristics of the B–2, but it has been a wise investment and we should capitalize on that investment now by funding the upgrades for the conventional precision guided munitions capability and some improvements to its ECM to allow it to be more effective in its role.

I was quite pleased with the outcome of the assessment. I fully expected it to come out that way, and I appreciate the committee's support for continued support of the B–1.

Senator LOTT. One last question and I will yield to Senator Nunn.

You have indicated that the B–52 would have to be equipped with standoff weapons, and yet we have a gap in our standoff capability for the B–52. So, until a replacement is found for the tri-service standoff attack missile, what are we going to do?

General LOH. Well, that is correct, sir. We do have a gap in our standoff capabilities, particularly for the B–52, and that is of some concern to me because——

Senator LOTT. That is a major concern.

General LOH [continuing]. Until you have a totally permissive environment, the B–52 can only be used to launch standoff weapons, and right now we only have a very few conventional air-launch cruise missiles that have been modified and a very few of these missiles called the HAVE NAP missile, neither of which is effective as a TSSAM would be or a TSSAM replacement would be. So, we do have a limitation and a gap in our standoff weapon capability right now that is of very much concern to the Air Force.

Senator LOTT. Senator Nunn.

Senator NUNN. Mr. Secretary, would it be accurate to say that this study, in effect, says if we buy all the things that are assumed in your report, then 20 more B–2s do not add very much to the margin?

Dr. KAMINSKI. Adding very much is certainly subjective, Senator Nunn. The measures that we showed were improvements on the order of between 5 and 10 percent in most of the measures.

Senator NUNN. You are assuming that we buy all the JDAMs that are now in the 5-year defense plan in this study, right?

Dr. KAMINSKI. Yes, sir, I am.

Senator NUNN. And you are assuming we buy all the JSOWs that are in this 5-year defense plan, and then you are assuming also that we buy a missile that we would call the "son of TSSAM" that Senator Lott just mentioned.

Dr. KAMINSKI. I am.

Senator NUNN. Then as I understand it, you are assuming we take all of the 5-year defense plan for JDAMs, JSOWs, and the TSSAM, which is not yet in there—and I do not think you know costs—but that we double the quantity of those. Is that not part of your assumption?

Dr. KAMINSKI. It is not an assumption. The assumption is that we bought everything that was in the plan. I did that one excursion in which I doubled our purchase of conventional munitions to show that that had a much bigger impact than did buying additional B–2s, but I did that as an excursion, Senator Nunn. Those funds are not in the budget to buy those additional weapons.

Senator NUNN. Do you think we need to have that capability? After doing this study, do you believe we need to double the JDAMs, double the JSOWs, and not only buy a son of TSSAM, but double the quantity that was originally planned?

Dr. KAMINSKI. I think we need some serious work in our munitions program. This study points out the high leverage that those munitions have. General Loh was commenting on the absence of sufficient standoff weapons for the B–52H. So, this is clearly a place where we need to buttress our program.

Senator NUNN. Of course, this study has been interpreted, whether that was the spin that was given it or whether it was not, as saying our current force posture is adequate. It seems to me that that is not what it says. It seems to me that what it is saying is that you need to greatly increase JDAMs, you need to greatly increase JSOWs, and you need to have a "son of TSSAM", and you need to double the quantities of those that were originally planned. And if you do all that, you do not need B–2s. That is the way I read it. Is that wrong?

Dr. KAMINSKI. No, sir. Let me show you the chart.

Senator NUNN. Well, you are saying, "No, sir". You mean that is not wrong. That is correct.

Dr. KAMINSKI. No, I do not agree with what you are saying. The conclusion we made on B–2s was independent of the weapons. What I was saying was that with our base program, we believed we could do the job. If I were spending my next dollar over and above what is in the current program, I would be spending that dollar on buying additional advanced munitions rather than spending it on buying more——

Senator NUNN. But you do not think we need to do that either.

Dr. KAMINSKI. I certainly think we need to construct a more robust munitions program. It is at the top of my agenda of——

Senator NUNN. So, you do not think the base force is adequate then?

Dr. KAMINSKI. I do think the base force is adequate, Senator Nunn.

Senator NUNN. Well, if it is adequate, why do we need to buy a lot more munitions that are not in the base force?

Dr. KAMINSKI. What we need to do I think is look for the high leverage piece of these munitions. As we put together our 1997 program, that is at the top of my agenda for achieving the leverage that these munitions offer.

Senator NUNN. That means we need to increase the munitions that are now in the base force.

Dr. KAMINSKI. Yes, sir. I would forecast that you will see an increase in the munitions over what is in the base force in our 1997 program.

Senator NUNN. And that also means the base force is not adequate. I do not see how you can get around that conclusion. It is just what you have said. It is what the charts show. You have got to have beefed-up standoff munitions and you have got to have a "son of TSSAM", which is not in the base force. And if you do all that, you do not need B–2s. That is the way I am reading what you are saying.

Dr. KAMINSKI. I guess I would say it in the following way, Senator Nunn. I think with the funding planned in fiscal year 1997, we will do a better job with a higher mix of conventional munitions in that program in our mix than we now have planned.

Senator NUNN. Let me ask you this. You sent your bomber study plan over last November or October. At that time you planned to have an option where the government would ". . . identify potential offsets that would permit the procurement of B–2s within available resources. Those offsets could include bomber and air-to-ground weapon programs, tactical strike aircraft, other rapid response forces such as Navy carriers, and possibly direct support forces such as fighter and defense suppression assets."

The only thing I see traded off here are more standoff weapons and retiring of bombers. Why did you not do any kind of options on retiring tactical aircraft as a way of paying for B–2s and looking at the effectiveness of those? It is my understanding that you did not do what you said you were going to do in the plan.

Dr. KAMINSKI. Senator Nunn, if you look at chart 3 in the briefing, our plan was to do this exercise in three parts depending upon the outcome of part 1. If the outcome of part 1 was, no, that we did not need more capability, then our plan was to proceed into the bomber industrial base study. If a decision was, yes, we needed more capability, then we were looking to undertake the effort you just described which is what should that capability be?

So, this is in the form of a decision chart. The first piece, part 1, I am not recommending, the study does not recommend, additional capability in B–2s. Therefore, our next step is the bomber industrial base.

Senator NUNN. But you did not look at tradeoffs in terms of whether additional B–2s would be of more value than current F–16s or current F–15s.

Dr. KAMINSKI. That is correct. We did not do that, Senator Nunn.

Senator NUNN. Why not? That was the heart of what the Air Force demonstrated up here when you had Secretary Rice as Secretary. He showed on a chart up there—it was an Air Force chart—on the procurement of additional B–2s and how many F–15s and F–16s that would be able to substitute for and replace. That was the heart of the things that we were trying to get to in this study. If you did not do that, you really have not looked at the tradeoffs as to whether B–2s are worth more than having the number of F–16s that we have right now. I understand that you only used about 20 percent of them in the Persian Gulf war. We had something three or four times that number. They have been wonderful aircraft, but why did you not at least look at these kinds of tradeoffs?

Dr. KAMINSKI. We did not think the direction, looking at what is in the content of the direction, caused us to do those trades, Senator Nunn. So, we did not look at trading off Army divisions or carriers or other assets in the Department. We limited our assessment to the bomber force and its compositions, and we did look at the weapons, but that was the extent of our activity. We simply did not look at those.

Senator NUNN. And I am very disappointed that you did not look at that because that contradicts some of the Air Force basic documents that were shown at a period of time when the Air Force wanted B–2s.

If I could ask one more. This is a long question, Mr. Chairman. I probably ought not start it.

Senator LOTT. No, go ahead. You take your time. You are on a roll here, so keep going. [Laughter.]

Senator NUNN. It is my understanding that the assumption in the basic study—I am not talking about the other side studies, but the basic study assumes that some 400 tactical aircraft are assumed to be deployed to each area of conflict, each MRC and to have arrived around D-day. It is also my understanding the study assumes two carrier battle groups on station around D-day.

My question is, based on those assumptions, I want to look back at what happened in October 1994, just last year, when the Iraqis started mobilizing and we had to move troops into that area and forces into that area. It was October 5 when we got notice that they were moving troops and tanks and APDCs. On October 10 they had already moved 75,000 troops, 1,000 tanks, 1,000 APDCS, and 750 artillery pieces south. That was the scenario that happened last October.

So, we started responding on October 6. Notice was October 5. My question is, did we have any carriers on station on October 6 in that part of the world?

Dr. KAMINSKI. I do not know the answer to that, Senator.

Senator NUNN. The answer is no. If I am wrong on any of this, correct me. But my answer at this point, based on the information I have, is no.

My question also, when did the first carrier battle group arrive in the gulf, and my answer to that is October 16, some 10 days later.

The next question, which is going to your assumptions too, was a second carrier sent to the gulf? And the Navy gives us the answer to that is they could have had a second carrier on station by October 22, 16 days later.

There may be some reason for this that is unusual, but there goes your whole assumption about carriers on this whole bomber study right there. If we were serious about putting forces in that area on October 6, maybe you can tell me something different happened. Maybe we did not take it seriously. Maybe we did not think we should put carriers there. The first carrier group would have gotten there on October 16. That is 11 days after we needed forces there.

You are assuming D-day. You are assuming day 1. Seventeen days later we could have gotten the next carrier there.

According to a transcript of a press briefing given on October 20 by a "senior defense official"—and I understand it is someone from Joint Staff—the choice for a second carrier battle group, to get it to the gulf, was among the *Kitty Hawk,* which was off of Korea, the *Constellation* in port on the west coast, the *Eisenhower* generating off of the east coast, or the *America* off of Haiti. That is my understanding. Those were the choices. You can see the distances involved in order to get a second carrier in that area.

According to the information I have, 4 days after the start of our deployment, 4 days afterwards, fewer than 100 land-based tactical aircraft reinforcement had actually arrived in the Middle East, fewer than 100. And we are assuming in this study 400 on D-day, on day 1.

According to the information I have, the aircraft that were deployed in that first 100 did not include any F–117 stealth fighters. So, we did not have any stealth in there in the first part of that deployment.

So, if that was a serious run at real life, we did not come anywhere close in that situation, without any second MRC going on, to meeting the basic assumptions that underlie this whole study.

Dr. KAMINSKI. Senator Nunn, if I look at the excursions that we did in light of the statements you have made, we did a number of these excursions. We slowed TACAIR arrival, as I indicated. We did 0 tactical warning time scenarios. We did scenarios to slow carrier arrival, so we had one on D-day, the next one not arriving until the end of the halt phase. We did the restrictions I described on TACAIR basing and sortie rates, reducing them by two-thirds for the first week and half for the second week and the like.

So, I think we have looked at some of those issues and tried to explore an understanding of those sensitivities. I showed the chart showing that those certainly do have an impact. If I went back to my chart——

Senator NUNN. Dr. Kaminski, let me just finish this a minute and then I will yield.

According to testimony Admiral Boorda gave to a House committee, when the *George Washington* arrived in the Persian Gulf on October 16, that carrier battle group—and that was some 10 days later, not day 1, but 10 days later—had about 80 percent of all the precision guided munitions available in the theater—80 percent.

So, the whole host of assumptions about the number of precision guided munitions, which a lot of them are not even in the budget, at this stage—at least TSSAM is not—are not there. We had less than 13,000 troops on shore, not counting the 2,000 Marines afloat. The Iraqis had 70,000 people mobilized.

Then the bottom line of all this, according to the senior defense official—again, I do not know who it is—briefing the press on October 20—and this is a quote from the news briefing—"It is my view, my judgment that the 9th and 10th"—and that was the 9th and 10th of October—"constituted a critical window when Iraq had some combat strength there which I would have judged to be adequate for a very limited military activity across the border into Kuwait and when probably our resistance would not have been enough to deter them."

So, according to this senior official, 5 or 6 days after we got notice on that situation, we did not have enough troops, aircraft carriers, tactical air bombers to deter Iraq which had just been decimated 3 years ago.

Now, the bottom line of all that, does the situation I have just described not represent better the real world than your study assumptions that have driven the outcome of this study?

Dr. KAMINSKI. I am not sure whether it does or it does not, Senator Nunn. All I can say is that what we did here was took our baseline planning numbers and then I ran each of these scenarios that I described, that is, reducing the warning time to 0, slowing TACAIR arrivals.

I can show you the classified charts if you would like showing what our aircraft arrivals looked like in comparison to what happened in Desert Shield and Desert Storm. I cannot do that in an unclassified briefing, but I have those classified charts.

Senator NUNN. Well, I have used more than my time, Mr. Chairman, and I thank you.

I guess my bottom line of all that is I really think that the assumptions of the Bottom-Up Review have to be put back on the table for some real examination in light of the world situation we now find and in light of the force structure we are going to have.

Senator LOTT. Thank you. Senator Smith.

Senator SMITH. Thank you, Mr. Chairman. Mr. Chairman, Senator Inhofe has to leave and I am going to yield to him.

Senator INHOFE. Thank you, Senator Smith. I regret, Mr. Chairman, I do have another committee meeting that started 30 minutes ago. I am going to have to leave.

I came here leaning toward the additional B–2s and I feel stronger in that position now.

Mr. Secretary and General Loh, I do agree with the statement you made about the B–1s and about the upgrade of B–1s, the necessity to have those in the fleet.

But the concerns I have that have not been answered are that it appears that there is an assumption of a static number of our aircraft in the bomber force which I do not think is realistic because that is going to change. It appears to me that you are talking about—I guess for the lack of better terminology—a static enemy technology, the fact that we would be using the B–52s to that extent that far in the future.

I come to this from a little different perspective because I fly old military aircraft, and interestingly enough, there is some discussion in one of the groups that I am in as to whether or not the B–52 should be thrown in with some of the World War II aircraft for that purpose.

You are talking about an airplane that is almost 70 years old by the year 2030, Mr. Secretary. I know that age alone is not everything, but certainly technology is something that concerns me.

Last my concern is the discussion about being able to work in two-MRCs. My numbers do not add up to the same numbers that yours do.

So, I agree generally with virtually everything that Senator Nunn has said in his questioning, and with that I will go ahead and go to my other committee meeting. Thank you very much.

Senator SMITH [presiding]. Thank you, Senator Inhofe.

Senator NUNN. I took so much time. I know I inconvenienced both of you. I apologize.

Senator SMITH. I was not going anywhere.

General, let me just run back through these numbers here for clarification. When we get 20 B–2s up into the force, how many of those would be on a given time in a non-operational status for, say, training or whatever other reason you wanted to use them for, repairs, whatever?

General LOH. Well, our plans are, when we buy and fully equip all 20 B–2s, at any one time 16 of them would be operational and be available for use for combat action and training.

Senator SMITH. The testimony here in total was 66 B–52s, 20 B–2s, and I do not know how many B–1s.

Dr. KAMINSKI. 95.

Senator SMITH. 95 B–1s. Now, if you break that down into the stealth situation, assuming there is an MRC or even one conflict—but let us say two—we now have, as I do the math, eight bomber aircraft in each MRC that have stealth capabilities. Is that correct? So far are you with me on that point? Sixteen for the two-MRCs, however you decide to break it out; correct?

General LOH. Our planning would have us deploying all 16 of those B–2s to the first MRC because of their great effectiveness and ability to be used to maximum effectiveness to stem that first MRC. We would send all 16 to that first MRC.

If then later a second MRC broke out, our intent would be to deploy all 16 of those to the second MRC under the presumption that by that time you would have had defenses suppressed adequately that the other bombers and the TACAIR could handle the level of defenses you have.

So, the B–2s are our most important asset in either MRC particularly for the first 1, 2, or 3 weeks.

Senator SMITH. They are the most important asset by your testimony, but they are the least number of aircraft out of the three categories of bombers that you have.

Now, let us make an assumption that you are not able, for whatever reason, to suppress enemy air defenses. Suppose we cannot do that. Are 16 bombers sufficient if we are unable to suppress the air defenses—16 bombers that can get through stealthily?

General LOH. Our tactics, our training, our deployments, our force structure are such that we do intend to suppress enemy defenses. We may not be able to do it on day 1 or day 2, but over a relatively short period of time, based on the forces of all the services, we fully intend to be able to suppress enemy air defenses even against the fairly sophisticated threat array. So, I do not subscribe to the notion that we are going to have to fight a conflict where we will be unable for any extended period of time to suppress defenses sufficiently to allow the full use of our force structure in an MRC.

But the point is, the first 2 or 3 weeks are extremely critical, and there may be situations there where we are not able to full dominate and control the situation and create a permissive environment for all TACAIR and non-stealthy bombers.

Senator SMITH. Let me pick up on Senator Nunn's last point about the Bottom-Up Review and the number of whatever—optimistic assumptions. Using those assumptions in terms of the bombers you need to fight, essentially what you are saying is the bombers that you need to fight one war you can use to fight two wars.

Realistically speaking, is it reasonable to believe that we can fight one major MRC with our bombers, all the accompanying logistics—Senator Nunn went into great detail about the other logistics—and then swing the entire force to another location looking at such things as munitions, fuels, spare parts, losses, not to mention mechanical failures?

Your testimony is that under the current scenario of not only bomber forces, but all the logistical forces that Senator Nunn described, that we could do that.

General LOH. We are forced to do that because of——

Senator SMITH. I am not asking if you are forced to do it. Can we do it? I know we are forced to do it if we do not have the capability. Can we do it?

General LOH. Given time we can transfer bombers from one major regional conflict to another. This does add some risk, and I believe that it is going to be a little more difficult than perhaps some people think because at the very time that we are trying to transfer over half of the bomber force from one war to another, perhaps halfway around the world, the rest of the logistics system is being stressed to the limit because we are trying to deploy other forces to that theater as well.

So, this is a concept that we have been forced to depend on because we do not have enough bombers to handle two-MRCs independently. The bombers have the capacity to do this swing, and that is an attractive feature of bombers, but it does add risk to being able to deal with that second MRC the way we would like to.

Senator SMITH. But is it not a fact that this is a budget driven scenario that would not be your first choice in terms of the support that you need?

Mr. Secretary, is this issue budget driven or is it national security driven? Are the bomber force and the logistics that you need to conduct two-MRCs a budget driven scenario?

Dr. KAMINSKI. I think our planning for this two-MRC scenario is consistent for all of the forces we are using, Senator Smith. I myself do not have the expertise in each one of these planning factors. I have relied on elements from the Joint Staff and the services. All I can say to you is that we used the same planning factors for all the rest of our forces that we used in this bomber assessment.

Senator SMITH. Let me be a little more specific, General or Mr. Secretary. Going back to Iraq, we flew all over the place with sorties looking for these Scud missiles and we did not have a great amount of success locating them. And that is the open desert. Now, if we are in the mountains and the valleys of Bosnia or somewhere in the old Soviet Union or someplace else, does it not make more sense to field a fleet of aircraft that are stealthy that could spend some time over those areas trying to find these missiles? Does that not make more sense than not having the capacity to do that?

General LOH. Well, I do not believe you are going to find any argument here. Dr. Kaminski and I are the strongest supporters of stealth technology and the advantages that stealth gives us that you can find anywhere in the Nation probably. We fully supported the B–2 program. We still do. The fact of the matter is we were forced to reduce the numbers of B–2s.

I think it is instructive to note that we arrived at the number 20 not because it was the right number, but because it was the minimum number that we could buy and have a significant operational capability. In other words, if we went to fewer than 20, we could not deal with deploying them to a major MRC and making a significant impact because we would only have enough to deal with small raids like the Libyan raid and other minor limited crises. So, we arrived at the number 20 as the minimum number that would give this Nation an operational capability that we could use in a major conflict. I believe at the time nobody said that it was the right number, and we were driven to 20 because of affordability and budgetary reasons.

This is the dilemma that we find ourselves in. Here we have a revolutionary technology, a revolutionary system. It works. The B–2s are performing magnificently well, and we have invested $24 billion in the R&D for this system. It is revolutionary and I think we should find a way to exploit the revolution. But we are not doing that because we cannot afford more B–2s.

The study shows that we ought to invest in precision guided munitions and I clearly support that conclusion and that outcome.

So, we find ourselves in a dilemma where we have this marvelous revolutionary capability but none of the service budgets or the defense budget can afford additional B–2s given current priorities. If more B–2s are to be procured, it is going to have to start with a higher priority for this sort of capability at the national level because we clearly cannot afford additional B–2s in the Air Force budget.

Senator SMITH. Let me ask one more question and then I will yield to Senator Nunn.

Dr. Kaminski, there have been a lot of bomber studies over the years, not just yours but others, and I am told there is a recent one involving seven former Secretaries of Defense, including Cheney who indicated 20 was enough and then apparently changed his mind in this decision. Can all of these studies be flawed and yours is the Rosetta stone? Yours is right and everybody else is wrong? And these other studies contradict what you are saying regarding the bomber force.

Dr. KAMINSKI. Senator Smith, I do not think the seven Secretaries of Defense actually conducted a study. They all signed a letter and I understand that.

There have been at least seven different bomber studies that I have been involved in in my career. This is the first bomber study that I have been involved in that included the use of tactical air. It is the one piece that distinguishes this from any others that I have participated in in the past.

Senator SMITH. I did not mean that the Secretaries were necessarily involved in the studies but they supported the study. They supported the result. That is a pretty dramatic statement especially from one who had opposed building more B–2s. So, I just wanted to get that in the record, that there are a number of different opinions at variance with your study.

Senator Nunn.

Senator NUNN. Thank you, Senator Smith.

General Loh, has this study persuaded you that you have enough bombers?

General LOH. Well I think, Senator, the fact that the only significant element of the force structure that has to be used in both wars is bombers should tell us something. In other words, there appears to be sufficient force structure in the other services to deal with two major regional conflicts with an independent set of forces—Navy, Army, Marines—for the most part. There may be some elements in the special forces that might have to swing to the second MRC.

But I think an interesting conclusion of the analyses that I have done and that others have done is that you come to the conclusion that in order to prevail in two major regional conflicts, you got to use a significant part of your force structure in both wars. That is the bombers.

That tells me just as a logical person that you ought to find a way to not have to do that, and therefore you need more bombers. The Air Force Bomber Road Map said that. The Bottom-Up Review even said that. So, I think that is an important conclusion that I draw from all of these studies, is that your strategy depends on using bombers in both wars and we ought to understand that better before we become more and more dependent on having to use the same force structure in two conflicts.

Senator NUNN. So, you do continue to believe we need more bombers than is now being planned?

General LOH. I would like not to have to depend from swinging at least half of them from war to another. We can swing some but, for example, this year 1996 I can only deploy 92 bombers, period, because that is all that are funded. We get a little bit better in the out-years as the B–1s come back into the force, but we never get up to 150 or 160 that I could use for combat action that is probably needed.

And also looking at the Nuclear Posture Review, we are doing some double counting when we look at a force like the bombers. We have the nuclear community saying we need at least 66 B–52s and 20 B–2s and the major regional conflict scenario that requires 100 deployable bombers to a single MRC. So, as the force provider of those forces, I come to the conclusion that I sure would like to have a few more bombers.

Senator NUNN. So, the B–2 is now being counted on for both nuclear and conventional missions?

General LOH. Yes, sir.

Senator NUNN. Dr. Kaminski, how do we justify that?

Dr. KAMINSKI. We reviewed with our steering committee, to include the Joint Staff, the deployment that we did and that was an acceptable arrangement for them. Our requirement is to maintain, I think it is, 66 B–52s and 20 B–2s as nuclear capable aircraft, but there was not a restriction to hold them back in-theater as we discussed that and reviewed that through our whole steering committee.

Senator NUNN. Are you going to be able to train crews and have the munitions and all that ready for both the nuclear and the conventional missions?

Dr. KAMINSKI. I think it would take some time to convert. I am not sure.

General LOH. It does take an amount of time to convert from one mission to the other.

Senator NUNN. How long?

General LOH. If they were deployed into a major regional conflict and you had to recall them and put them up on nuclear alert, it is probably on the order of several weeks.

Senator NUNN. Suppose it is the other way around. Suppose they are on nuclear alert and then you have a regional conflict and you have to use them. How long does it take to get them ready for the conventional?

General LOH. Just a matter of a day or two.

Senator NUNN. It is a lot quicker to convert from nuclear to conventional than conventional to nuclear?

General LOH. Given the fact that in the conventional to nuclear case they are already deployed overseas and they have to be recalled and refurbished and brought up to nuclear capability.

Senator NUNN. General Loh, how much attrition will you have, given a steady number of bombers that is now being projected? How many will you lose between now and 2014 just in peacetime, normal peacetime attrition?

General LOH. Well, we are getting better and better of course in our safety record all the time. We lost a B–52 last year. We have lost three B–1s. So, over the past 5 or 6 years, we have only lost a handful of bombers. I think prudent planning would say that we are likely to lose one every year, maybe one every 18 months.

Senator NUNN. So, in 2014, we would have roughly 20 less prudent planning-wise.

General LOH. Those are the normal attrition reserve factors that we would allocate to the bomber force structure. Right now we do not have an attrition reserve because we are using them all for training combat and then those that are in depot status.

Senator NUNN. Dr. Kaminski, do the charts not show no attrition loss of any bombers?

Dr. KAMINSKI. They assume the attrition reserves; that is, we did not use all 20 B–2s in the conflict. We used less than that.

Senator NUNN. It is my understanding there is no peacetime attrition shown in any of the charts for the bomber force.

Dr. KAMINSKI. I need some help. I think what we did was deployed the forces, which included our planning factors for reserves.

Senator NUNN. What does that mean?

Dr. KAMINSKI. It means we deployed fewer bombers than we had allowing for those reserves.

Senator NUNN. Well, does that mean that you are allowing for peacetime attrition or does it mean you are not?

Dr. KAMINSKI. We are.

Senator NUNN. Your chart still shows 181.

Dr. KAMINSKI. That is the number that we had in the force, that number 181, Senator Nunn, when we deploy the bombers, we reduce the number that is actually deployed. I think the reserves are classified, are they not? We can show you what those numbers were in a classified session.

Senator NUNN. If we had to use bombers in some distant place, remote, Ukraine, Kazakhstan, any place like that, parts of China, if we ever had to—I know this is hypothetical—where are the tactical air and aircraft carriers going to deploy from?

Dr. KAMINSKI. I do not know the answer to that, Senator Nunn.

Senator NUNN. In that sort of situation, are not all these assumptions sort of out the window?

Dr. KAMINSKI. In this analysis, we looked at the two-MRCs. That was the extent of our work. That was our congressional direction, to look at the two-MRCs, and that was the same basis of planning.

Senator NUNN. Is it not true that if we have any kind of contingency anywhere in the world that is remote and not where we already are located with tactical air like we are in the Middle East and Korea that we get into big problems very quickly with the number of bombers we have? Because we would have to rely almost exclusively on bombers in the first couple of weeks, would we not?

Dr. KAMINSKI. Certainly if we are in situations where there is no tactical air, no tactical air bases, and carrier air cannot get there, we are going to be in the position of relying on the bombers or on allies who may be in the area.

Senator LOTT [presiding]. Senator Smith.

Senator SMITH. Just one quick point, Mr. Chairman. I know you want to wrap up.

General Loh, in Desert Storm the F–117 obviously did a great job in penetrating and hitting targets with a very good ratio. When you compare it, though, to the stealthiness of, say, the B–2, you could get—what is it—roughly eight times more the number of bombs or the capacity to bomb between the two aircraft. So, if the F–117 was able to strike the majority of hard-to-hit targets with the fewest number of sorties, it just seems to me that capping the B–2 at 20 planes does not make sense.

Now, I do not have any direct information at my fingertips, but I am told that in the first 24 hours of the war in Desert Storm, we had something like 45 sorties of the stealth aircraft, the F–117, hitting—I do not know—75, 76 targets, but at the same time the non-stealth aircraft flew 800 or 900 sorties and hit roughly the same number of targets, 80, 85, 90 targets. That is incredible.

General LOH. Well, that shows the leverage of stealth technology. You do not have to carry along a cohort of additional support aircraft to provide for the survivability.

Senator SMITH. You add to the stealth technology the number of bombs that you can add onto the aircraft and you would save lives.

General LOH. That is one of the reasons why our Nation has invested heavily in stealth technology, for just those attributes and advantages. It renders obsolete an enemy's integrated air defense system and the investment that our enemies have made in radar technology over the last 50 years.

Senator SMITH. So, the answer is we have spent tens of billions of dollars and waste all that technology, all that study, all that money on 20 aircraft, all that technology.

General LOH. Well, we have 20 B–2s. We have a number of F–117s. We are still investing in stealth in the F–22 program and in the JAST program. So, we are maintaining our commitment to stealth, but if you are a businessman, it is difficult to contemplate the fact that you have invested this much in the B–2 and you are capping production at 20.

Senator SMITH. I yield, Mr. Chairman.

Senator LOTT. Thank you, Senator Smith.

Would the distinguished Chairman have any comments at this time, Senator Thurmond?

Chairman THURMOND. Thank you, Mr. Chairman. I have just a couple of questions, if you would permit me to ask those.

Senator LOTT. Could I do just one bit of business here?

Chairman THURMOND. Sure.

Senator LOTT. We do have the statements from a second panel, but in view of the hour, we will put those statements in the record and will not be able to call the second panel.

We have had real good opportunity to question these two witnesses and there are other questions. I know Senator Hutchison came back to ask some questions. Senator Exon is now here, and of course our distinguished Chairman.

So, to our second panel, we will put your statements in the record and forego that second panel today.

[The prepared statements of General Welch and General Goodson follow:]

PREPARED STATEMENT BY MAJ. GEN. JASPER A. WELCH, JR., USAF, (RET.)

Thank you Mr. Chairman and members of the committee for the opportunity to address this hearing on two critical, fundamental issues for the post-Cold War era——

1. To what extent should the Nation rely upon warning and how much could a strong bomber force mitigate such reliance?
2. Could an aggressor impede or delay our force deployment and how well could a strong bomber force cope with that situation?

The first issue, reliance on warning, is an enduring policy issue but with some new technical aspects. The second issue has turgid immediacy with the proliferation of missiles carrying chemical warheads or worse.

Long-range bombers are not, of course, the only method of dealing with these issues, but they are conceptually a powerful method. The Nation needs to know how well, and at what cost, a carefully crafted bomber force could meet these challenges.

Let me remind us all here today that these issues arise from actions to be taken by adversaries; actions over which we have only limited control. These are matters of risk mitigation: How likely is the untoward event, what are the consequences of a bad outcome and how much would it cost to avoid the risk?

There is a third issue, as addressed by the OSD bomber study,

> 3. Given that we rely on warning, have enough warning and act decisively, and given that the aggressor is unable to do anything to significantly impede our force deployment, and given that the targets are within fighter range of enough bases, then how strong a bomber force do we need to augment our short-range land-based and sea-based airpower?

I want to emphasize that this third issue, as important as it is, is a quite different issue. Moreover, the analysis of this is of only tangential value in addressing the first two fundamental issues. I will return to explain the rationale for these judgments later in my statement.

BACKGROUND OF THE WITNESS

But let me pause a moment to describe who I am and why I am here. I have provided to the staff some biographical information. Briefly, it says that I am a technical person who served 31 years in the Air Force before retiring in 1983. I am appearing here at the invitation of the committee as a private citizen.

That is, although I am a retired General Officer of the Air Force, I do not represent the Air Force; although I am a formal consultant to the Office of the Secretary of Defense, I do not represent the Department; although I chair the Military Advisory Panel: to the Director of Central Intelligence, I do not represent the intelligence community and although I have some industrial clients with clear interest in these proceedings, I do not represent their interests.

I have received no guidance, direction or comments from any of these institutions in preparing this testimony—with one exception. Dr. Kaminski and I did meet earlier this week to exchange and discuss earlier drafts of our prepared statements. That is not to be construed as his endorsement of anything I have to say.

In my appearance I will, at various times, take on several roles. For the most part I will act as an analyst—sharing with you my insight as to how best to frame the questions and how best to relate, one to another, the wide range of considerations that bear on the matter. At other times I will be an advisor, urging on you certain concrete actions that I judge both practical and necessary to the national interest. I will occasionally act as an advocate and as an apologist, but only when I deem those roles useful in clarifying my statement.

LESSONS LEARNED FROM PAST ANALYSES OF BOMBER FORCES

Over the last few years I have performed a number of analyses of the role of long-range bombers in conventional conflict. These were done principally on my own time and in direct response to concerns raised by then Congressman Les Aspin and more recently by Senator Nunn. I have prepared four reports on these analyses; all of which are available to the committee.

The first, dated January 1992, contains some 80 pages of detailed considerations—technical, tactical, operational and strategic—that bear on the utility of long-range bombers in conventional conflict. At that time many in the national security community envisioned bombers purely as strategic nuclear delivery vehicles.

A major value of that work was to quantify and emphasize the role of intensity in air attack. That is, historically, almost all target systems have taken emergency actions to reduce their vulnerability when subject to air attack. Moreover, an adversary is motivated to take strategic actions to offset such damage as is suffered. Accordingly, unless the air attack is of sufficient intensity to overcome these reactions, then the air attack is, at most, a waste of sorties. In most scenarios this intensity consideration dominates the choice of tactics and weapons. It is usually material in establishing force level requirements.

Another major value was to quantify the size and composition of the target systems relevant to major post-Cold War contingencies. The basic scenario, threat and target systems were quite comparable to those in Congressman Aspin's force level analyses in the spring of 1992 and in the Major Regional Contingency of the 1993 Bottom-Up Review.

That first paper developed estimates of the bomber force levels that would be required to fully cover the quantified target systems and taking into account the intensity consideration. The scenario was one wherein the short-range aviation forces were delayed (whether due to lack of warning, logistic lift, enemy action or lack of bases within range). The minimal force level estimates were about 200 bombers.

These were minimal estimates in that they were based on an abundant supply of modern precision weapons, forward basing and maximum feasible sortie rates.

With these levels of forces, weapons, basing and sortie rates the military situation could be stabilized within about 10 to 14 days and held until the major intervention forces could arrive.

That first paper did not investigate aircraft losses to defenses well enough to come to a definitive view on bomber force mix. It did suggest a B–2 force of between 20 and 60 inventory aircraft, if added to a force of 80 PAA B–1B and 80 PAA B–52 aircraft.

The paper pointed out that the number of B–2s required was directly tied to the number needed (a) to halt the invasion quickly and (b) to roll-back and draw down the air defense system quickly so that the non-stealth aircraft could become fully effective.

Finally, that first 1992 paper did develop the essential cost trade-off between stealth aircraft that largely overfly target areas and use relatively inexpensive munitions and non-stealth aircraft that would need to use more expensive stand-off munitions until the air defenses could be reduced to manageable levels.

The second paper, published in May 1994, dealt with the particular problems posed by the fiscal year 1995 President's budget, which proposed to sharply reduce the number of active B–1B and B–52 bombers.

That proposed reduction left the bomber force, even with eventual delivery of 20 B–2 aircraft, quite unable to stabilize an MRC sized threat in a timely fashion in the absence of short-range airpower.

In order to come to that conclusion the methodology of the first paper had to be expanded to include, quantitatively, the interaction of stand-off weapons effectiveness (against a wide array of targets and target systems), cost and aircraft losses. Moreover, the allocation of the forces, by day, by weapon type and by target had to be carefully constructed to assure that the combat outcome represented the best that each force could achieve.

That is, the weapon consumption by number and type, must be allowed to vary with bomber force structure in order to know what combat performance could be delivered by any particular bomber force.

Unfortunately, the instructions to the OSD bomber study dictated the use of a fixed weapon inventory, independent of bomber force composition and size. Moreover, the base case inventory was woefully inadequate for even the base case forces, as the OSD study results show. As a consequence, none of the OSD bomber force results in the baseline represent the best that those forces could achieve.

The second paper then went on to examine several paths toward improving the performance of the bomber force. The most cost-effective path was found to be extensive use of relatively far forward bases. The most interesting basing distance is about 1000 nautical miles: it is far enough away to sharply curtail enemy action against it, it provides a fair amount of political flexibility in choice of host country and it brings the bomber sortie rate near its maximum.

The paper used all modern precision weapons and maximum feasible sortie rates on the grounds that any decision to invest in bomber forces for the strategic purpose of risk mitigation would be accompanied by adequate funding for crew manning/training and for weapons. The OSD baseline treated resource choices for weapons and crew manning/training as independent of that strategic decision.

In looking toward more capable forces, the May 1994 paper examined (a) retaining more of the B–1B and B–52 aircraft, (b) counting more on deployment of theater forces (both land-based and sea-based) and (c) adding additional B–2 aircraft. Of these, the paper found additional B–2 aircraft to be the most cost effective. I have been told by the IDA study director that when his team analyzed a similar case, IDA also found a high value to adding B–2 aircraft.

This point deserves some amplification. In the OSD baseline, and in many of the excursions, there are three critical differences between the OSD study and my analyses:

First, the OSD force levels of short-range aviation are almost sufficient to carry the campaign without any bombers; whereas my work was directed toward understanding how to mitigate the risk entailed if the short-range forces could not get there due to lack of warning, political inhibitions to initiating deployment prior to hostilities, enemy action against the in-theater airfields or the unavailability of airfields close enough to the conflict.

Second, the OSD analysis almost always assumed that fighter escort and ECM would be sufficiently effective, and available in sufficient quantity, to allow B–1B aircraft to have very good survivability even before the air defenses were rolled-back and destroyed; whereas my analysis was more skeptical of those penetration techniques (more on this point later) and relied primarily upon stand-off weapons until the defense suppression was well underway.

Third, the OSD baseline centers on tactical forces for the year 2014 and projects substantial numbers of new model, stealthy ground-attack fighters to be available; whereas my analysis did not project fighter force improvements beyond the F–18E/F. Neither the OSD study nor my analysis took into account any costs of modernizing the short-range forces beyond today's inventory.

This committee needs to keep in mind that the planned costs to modernize the short-range forces are many times the cost of an aggressive program to modernize the bomber force, including the purchase of an additional 20 or even 50 B–2 aircraft.

Accordingly, if one were to base the decision on bomber force on an analysis of "issue three", the combined effectiveness of short- and long-range forces, then one would be obliged to include the combined costs of both forces. Regrettably, the OSD bomber study addressed the combined effectiveness, but not the combined costs.

The third paper is a magazine article, intended for a non-analyst audience, that summarized the results of the second paper in the December 1994 issue of Air Force Magazine. Most readers have found the article interesting and helpful in their understanding. Some have misunderstood various aspects of the article and complained, sometimes bitterly, sometimes behind my back, often without bothering to read the underlying papers or asking me for clarification. So I would warn the committee that not all of what has been attributed to my work is accurate. I would encourage all parties to read or ask before thinking that you know what I said.

The fourth paper, prepared this spring, is in a Question and Answer format, intended to deal with a wide range of questions and concerns raised with respect to my analyses.

In particular, the fourth paper deals with concerns raised by my long-time colleague, Dr. Leon Goodsen, who is here today. His main concern was one of methodology. We have met and discussed the matter at length and have reached agreement that I did indeed follow a best use of force methodology. To be sure, he still prefers his particular best use of force methodology.

In addition, I should point out that our two works have centered on somewhat different threat depictions, both plausible, both consistent with known intelligence—that has led to a somewhat different view of the relative merits of B–1B and B–2 aircraft.

We both agree that if plausible variations in threat result in material differences in outcome, then one must treat the threat uncertainty as a risk mitigation issue: How likely is the untoward event, what are the consequences of a bad outcome and how much would it cost to avoid the risk of being wrong about the future?

Aside from that, our results and methods are consistent. His work is richer in detail in some respects, mine in others. His work did not focus on the issues of stand-off weapon cost, as did mine, but we are both in agreement that the provision of adequate modern munitions is the critical issue for all airpower, and for bombers in particular.

Dr. Goodsen and I also agree, as does Dr. Koleszar, that there are a number of planning factors as well as tactical and operational issues for which there are substantial uncertainties that affect outcomes to a material degree. We are hopeful that adequate reduction in uncertainty could be obtained, through analysis, simulation and field exercise. Until theses uncertainties are reduced the Nation will run unnecessary risks or costs or both.

Some typical examples where uncertainty is now too large include:

(a) the quantitative impact on the operational productivity of airfields and ports throughout a sequence of repeated attacks with chemical warheads (finding out this data is not the mission of anyone today),

(b) the quantitative effectiveness of fighter escort (there is reported to be differences in doctrine, tactics and effectiveness between the Navy and Air Force) and

(c) the operational impact of massive air attack with modern munitions on rapidly maneuvering ground forces (the Army Chief of Staff has recently suggested that, in the future, the motion of a "forward line of troops" (FLOT) will not be a valid paradigm for addressing ground combat).

SOME COMMENTS ON THE OSD BOMBER STUDY

At the outset let me assure the committee, and the IDA study team, that these comments are intended as guidelines for necessary future extensions of the study effort. The IDA team is well known to me. I have always found their work to be professional.

But the committee should know one of the "trade secrets" of the defense analysis business—that the most valuable and best work on a study usually comes after its first presentation to its sponsor and after its first presentation to outside analysts. The OSD bomber study is no exception. A number of very interesting results have been obtained after its presentation to Dr. Kaminski in late April and after its public presentation in early May.

So as an aid to making the OSD bomber study relevant to bomber force decisions, primarily by addressing directly the first two issues (the value of bombers in the event the short-range forces cannot get to the theater, for whatever reason), I will outline below some needed extensions and changes in its structure and perspective.

From the perspective of a working analyst in the field, the OSD bomber study, in its current form, is vulnerable to criticism on five distinct levels as follows:

Level 1: The Issue Addressed

As discussed at the outset of this statement, the OSD bomber study addressed, as its baseline, the third issue:

"3. Given that we rely on warning, have enough warning and act decisively, and given that the aggressor is unable to do anything to significantly impede our force deployment, and given that the targets are within fighter range of enough bases, then how strong a bomber force do we need to augment our short-range land-based and sea-based airpower?"

The answer to this question, taking the results of the OSD study at face value, is that we do not need much of any bomber force to augment the short-range forces if they are almost all in place at the outset of hostilities. That is true because the short-range forces are strong enough, in the particular scenario chosen, quite independent of the capabilities of the bomber forces considered.

Accordingly, there is little to be learned about the capabilities of the bomber forces to handle matters if the short-range forces are not in place, the final point made at the outset.

Thus the main thrust of the OSD bomber study is of limited value for someone who is interested in the first two issues, viz.,

"1. To what extent should the Nation rely upon warning and how much could a strong bomber force mitigate such reliance?

2. Could an aggressor impede or delay our force deployment and how well could a strong bomber force cope with that situation?"

To be sure, there were a number of excursions made to the baseline. Unfortunately, the value of these excursions is also limited by difficulties addressed below under Levels 2 through 5.

Level 2: The Definition of an MRC

The term, Major Regional Contingency (MRC), came into currency with its use in the 1993 Bottom-Up Review (BUR). The Bottom-Up Review posited as its base planning scenario two nearly-simultaneous MRCs. Moreover, each of the two was to be a surprise as to when and where. The BUR even had a picture to illustrate that although it was permissible to use Korea and Iraq as nominal examples, the "real MRC" could be anywhere and planning should take that into account if it mattered.

This planning scenario is pretty stiff medicine, to be sure. It led me and others to expect a serious interest in forward presence, of stocks and selected force elements, and a serious interest in a strong bomber force.

But the OSD bomber study has a quite different "two MRC scenario" than did the Bottom-Up Review, even though it is called by the same name. The OSD bomber study scenario has ample warning as to when and where (about 80 of the short-range forces are in place at the opening of hostilities). It chooses Iraq and Korea as the places (thus assuring that there are adequate number and quality of air bases and that all of the short-range aircraft can reach useful targets).

This change in the two MRC scenario definition substantially improves the ability of the short-range forces to handle the scenario, leaving little need for augmentation by the long-range bomber forces, whatever their composition.

This change in the two MRC scenario definition also allows fighters to escort non-stealth aircraft all the way to the target, which would not be possible in other geographical settings. Fighter escort is absolutely critical to the results of the OSD bomber study, including all excursions performed to date.

Level 3: The Structure of the Analysis

The OSD bomber study was structured to fix the weapon inventory, even when comparing bomber forces that varied widely in weapon carrying capacity. Moreover, the bomber forces competed with the short-range fighters for the same weapons inventory. Finally, the weapons inventory chosen for the baseline was quite constrained in high quality weapons.

As a result of this weapons constraint at low levels, all variations in bomber forces resulted in only a marginal impact on the outcome. That is, additional bombers had only two choices: (a) use the left-over, low effectiveness weapons and (b) take high effectiveness weapons away from other aircraft, which would then cave to use low-effectiveness weapons. Either way the number of high effectiveness weapons delivered would be the same.

Of course, additional aircraft could deliver the highly effective weapons faster, an important matter in the real world, but the OSD study methodology was not particularly sensitive to this matter.

Thus the observed marginal impact in the OSD bomber study of either adding or deleting bombers is an aberration of the analysis structure and not a fundamental attribute of bomber forces.

Quite apart from this analytic view, it is simply not a consistent policy to constrain the effectiveness of expensive aircraft with an inadequate weapon inventory, be they short-range or long-range, be they stealthy or non-stealthy. Nonetheless, the past and current Defense budgets have generally under-funded high quality weapons.

To be sure, the OSD study results note, in an excursion, the dramatic impact of increasing the weapon inventory, an observation made repeatedly in past studies by the RAND Corporation. But having noted this impact, the OSD study did not take the obvious and sensible step of re-baselining to an adequate inventory. If this had been done, then the results of addressing "issue three" might have had something useful to say about the first two issues.

To turn to another structural matter, the OSD study chose to let the losses of aircraft to enemy air defenses be an output, floating in value depending upon the forces used (and, of course, upon the threat).

This is a satisfactory approach for evaluating the relative ability of various forces to survive. But this approach fails to capture the essence of air campaign execution, in which commanders invariably choose to manage losses across the campaign by changing tactics, targets or objectives. Thus the outcome of an analysis with varying losses will engender hesitation in its acceptance.

From a force planning point of view, a key attribute of a force is to be able to manage its losses, across a wide range of threats and to a politically and militarily tolerable level (both will vary from campaign to campaign). Accordingly, the full evaluation of the operational suitability of any aircraft force should include an investigation of the ability to manage its attrition.

The survivability of the B–1B, and to a lesser extent that of the B–52, in the OSD study depended largely on the effectiveness of the B–1Bs ECM and upon the effectiveness of fighter escort.

For the short term, when defense characteristics are relatively well known through intelligence on existing threat systems, estimates of ECM effectiveness have reasonable levels of uncertainty. In fact, the IDA analysis team has a well-developed and highly respected capability for making such estimates.

For the far term the uncertainty grows, particularly since in the particular far term at hand there will be a vast proliferation of digital signal technology through commercial channels. This will erode our long-standing technical edge in the ECM–ECCM contest.

As to fighter escort, it should be remembered that this requires that the targets be within un-refueled fighter range from the edge of hostile airspace. The second requirement is that there be enough fighters to escort all of the strike aircraft.

Accordingly, for excursions that address cases of delayed entry of short-range airpower, the ability to escort non-stealth bombers should be reduced, perhaps dramatically, from the baseline case. But in the excursions done to date, the OSD bomber study has maintained the same level of fighter escort effectiveness, even for results displayed on charts (inadvertently) labeled "no TACAIR" and "delayed TACAIR".

In assessing the effectiveness of fighter escort it is necessary to include the propensity of the strike aircraft to jettison their weapons, or otherwise abort the mission when they or their escorting fighters come into contact with hostile aircraft. In North Vietnam this propensity was typically on the order of 50 percent. The OSD bomber study does not include this effect.

Finally, if the B–1B is dependent upon fighter escort, then the costs of providing that fighter escort force structure should be associated with the 25 year cost of the B–1B; this has not been done in the OSD bomber study.

Level 4: The Choice of Planning Factors

A critical planning factor in the OSD bomber study is the strength and capability of the in-place friendly forces, both ground forces and air forces. If these are strong, then there is a diminished criticality of rapid deployment of short-range air power as well as a diminished need for long-range airpower.

The OSD study estimated the in-place friendly forces to be relatively strong. In most cases the combat effectiveness of U.S. equipment in friendly hands was estimated to be comparable to its combat effectiveness in U.S. units. But this is surely a planning factor about which we must be essentially uncertain, at least in the distant future. In Vietnam in 1975 we vastly overestimated the staying power of the local forces even in the short term, even with very good knowledge of their size, equipment and training.

Similarly, our ability to project adversary force size, composition and training far into the future is quite limited. Yet the OSD study treated these intelligence projections as relatively well specified.

Both of these matters should have been treated in a risk management matter: How likely is the untoward event, what are the consequences of a bad outcome and how much would it cost to avoid the risk?

Another critical planning factor is aircraft sortie rate, since it trades directly with force size. A confident estimate of sortie rate depends upon the level of manning (particularly air crews and immediate ground crews), training tempo and logistics support. These, in turn, can and have varied from time to time, depending upon budget pressures and an overall appraisal of the importance of readiness for the relatively near future.

Accordingly, it is not appropriate to use current support levels to predict sortie rates in the distant future, as was done in the OSD bomber study. The preferred, and quite standard approach in force structure analyses is to use reasonable upper limits on sortie rates and then to provide the resource base necessary to support these rates.

Another critical planning factor is the ability of various aircraft to employ the new, much more highly effective weapons. We are now in a transition period wherein not all aircraft types are currently configured, or have funded programs to be configured to carry the highly effective weapons. Since these new weapons are typically 10 times as effective per unit payload as the older weapons they replace, it makes a big difference as to which weapons are available for which aircraft.

Accordingly, it is not appropriate to use current configuration programs to predict weapon carriage capability in the distant future, as was done in the OSD bomber study. In most excursions done to date, the B–2 performance is significantly penalized in this manner. The preferred, and quite standard approach in force structure analyses is to use reasonable upper limits on weapon carrying capabilities and then to provide the resource base necessary to support these capabilities.

Some planning factors have logical or policy connections between them. Of interest here are the connections among those factors that go toward making each proposed bomber force the best that it can be. That is, if we were to purchase additional B–2 aircraft, then we would want to supply them with good bases, adequate munitions and the manning/training/logistics to achieve high sortie rates. Similarly, if we are to keep B–1Bs, then they should be well supported and configured to carry highly effective munitions.

Such matters also cost money, but a package, balanced on cost effectiveness considerations, would be the appropriate building block for force structure analysis. The OSD study appears to have chosen some planning factors quite independently, without consideration of such logical and policy connections.

Level 5: The Approach to Presentation

The OSD study uses a presentation approach of a "baseline case" with "excursions" to vary various assumptions and input planning assumptions to illustrate sensitivities. This is a reasonably common form of presentation. It serves well when the "baseline case" is relatively free of strong constraints and when the "excursions" are relatively free of cross interactions.

However, as discussed above, the OSD bomber study "baseline case" has several strong constraints that reinforce one another: (a) the in-place friendly forces are strong, (b) the short-range aircraft forces have plenty of time to deploy before hostilities, (c) these sort-range forces can reach all targets and escort all non-stealth aircraft to their targets and (d) the weapons inventory is fixed at an inadequately low value. The full impact of these strong constraints has not been revealed as yet.

As to whether the "excursions" are free of interactions, one cannot be sure, as the OSD study excursions are generally taken one at a time. Usually there are some important cross interactions in an analysis as complex as this. It is the clearly the burden of the study presentation to demonstrate that important cross interactions do not exist. This has not been done as yet.

These issues are not easy to address in conducting and presenting complex studies—but it is critical to address them well. Not to do so can obscure and distort the understanding of the results—particularly for non-analyst audiences.

ADVICE TO THE COMMITTEE

At the outset I promised to take the role of an advisor. This may or may not be entirely welcome. But compared to the preceding pages of "analyst talk" I suspect that it is a welcome change of pace. I will group my advice into three parts:

How to think about bomber force needs?,
What to do now with the OSD bomber study? and
How to approach budget adjustments?

SIZE AND COMPOSITION OF THE BOMBER FORCE

My principal advice is to focus on the first two issues:

> To what extent should the Nation rely upon warning and how much could a strong bomber force mitigate such reliance?
>
> Could an aggressor impede or delay our force deployment and how well could a strong bomber force cope with that situation?

These are the proper determinants of the bomber force needs, both in size and composition. In contrast, the third issue,

> Given that we rely on warning, have enough warning and act decisively, and given that the aggressor is unable to do anything to significantly impede our force deployment, and given that the targets are within fighter range of enough bases, then how strong a bomber force do we need to augment our short-range land-based and sea-based airpower?

as addressed in the OSD bomber study, is also important, but it is really more critical to evaluating the size and composition of the short-range forces (land-based and sea-based tactical aviation).

Second, you should recognize explicitly that many important matters are inherently uncertain (e.g., future force capabilities for adversaries and friendlies alike, the quality of warning, our ability to act on warning and the future proliferation of missiles with their ability to interfere with our deployments). Such matters should be treated as risk management issues: How likely is the untoward event, what are the consequences of a bad outcome and how much would it cost to avoid the risk?

Third, you should recognize that stealth and precision munitions allow airpower to achieve the vision held for it in the beginning, before the realities of missing targets and getting shot down set in. With stealth and precision weapons, strike aircraft can go where they need to go, whenever they need to and destroy enough, fast enough to make a real difference.

THE OSD STUDY

You should recognize that the OSD bomber study, as presented to date, has primarily addressed only the third issue—and it has done so in such a manner as to give little insight into the main determinants of bomber force size and composition.

You should request OSD to extend the bomber study to address the critical first two issues. The study methodology can easily be adapted to do so. If so directed, I am confident that the IDA study team can do a competent job.

You should request OSD to re-baseline the bomber study, even for addressing the third issue, to a weapon inventory that does not dominate and contrive the results and otherwise to revamp the study to eliminate its current vulnerabilities to criticism.

ALLOCATION OF FUTURE BUDGETS

You should allocate enough resources and responsibility to obtaining badly needed data upon which to reduce the uncertainties in our understanding of airpower, both for short-range tactical aviation and long-range bombers.

You should get the modern weapon resources (e.g., for R&D, weapon inventory objectives and aircraft modification) on a higher priority in the balance with aircraft modernization for both short-range fighters and long-range bombers.

You should set resources for stealth aircraft on a higher priority in recognition of stealth's central role in undermining all adversary efforts in air defense and in assuring that U.S. airpower can continue to be a major instrument in national security.

You should set resources for long-range bomber forces on a higher priority with respect to short-range aviation in recognition that the current allocation is somewhere between 10 to 1 and 20 to 1 in favor of short-range aviation and in recognition that there are substantial risks and opportunities that long-range bombers can cover but that short-range aircraft cannot cover.

FURTHER B–2 PRODUCTION

All things considered, taking my appraisal of the post-Cold War world, taking my best view of the entire defense budget, taking account of my specific knowledge of the relevant intelligence and advanced technology and taking account of my substantial knowledge of many more parts of the defense business than we have discussed here today, I do advise you to continue production of B–2 aircraft. In my judgment the risks to be run in stopping now are too high, and the budget adjustments are too modest, not to proceed.

PREPARED STATEMENT BY BRIG. GEN. W. LEON GOODSON, USAF (RETIRED)

BOMBER MODERNIZATION

Mr. Chairman, members of the subcommittee and staff, thank you for the opportunity to appear here today to add what I can to the discussion of bomber modernization. I am here as an invited guest. I represent only myself—not any government agency or contractor. My primary areas of expertise are: (1) methods of campaign analysis appropriate to the higher level decisionmaking where fundamental decisions on force structure and composition must be made, and (2) military operations.

You have asked me to emphasize methodology, particularly as it applies to the problem of heavy bombers. I will summarize with a few major points on analysis methods, interpret these points with respect to current major bomber analysis efforts, including the one presented today, and introduce a paper which I have prepared for the record which applies the suggested analysis methods to the problem of evaluating bomber force improvement options.

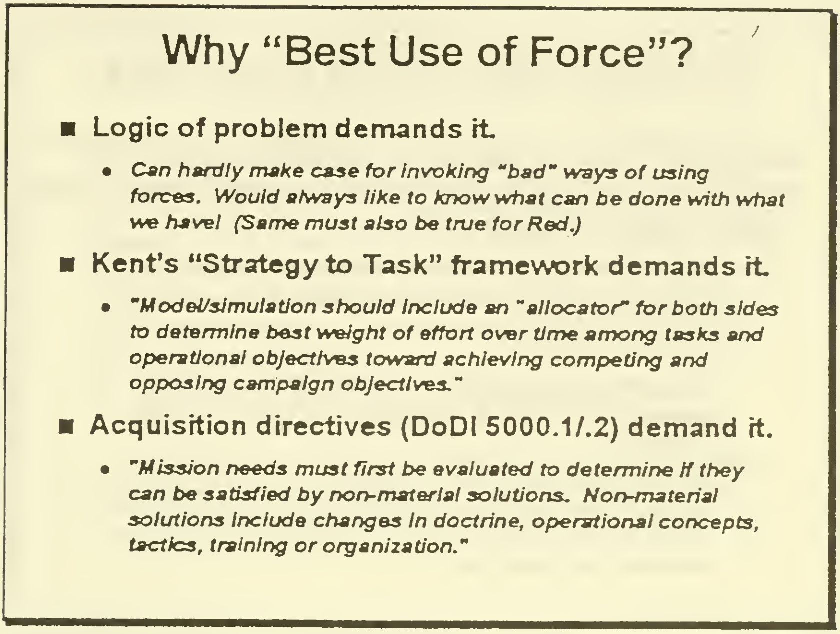
I believe that with some exceptions, we of the analysis community have done well helping with resource allocation decisions only at lower levels (engagement and below) within narrowly defined stovepipes (missions, operational functions) where dollar implications are small. We have provided little help at higher levels. To support resource allocation decisions at higher levels requires huge expansion in the scope of the trade space to the broadest range of options, and reliable analysis methods at Joint Theater-Campaign level. In a nutshell, there has been the rub. Our analysis methods at Joint Theater-Campaign level have not been reliable.

Bridging stovepipes requires evaluating force elements that perform disparate wartime functions.

- Tanks vs airplanes vs ships vs . . . almost anything else.
- Artillery vs reconnaissance elements . . . almost anything else.

Evaluation of disparate functions is even required in deciding among some desired features of single systems, for example sortie rate vs radar range vs signature vs VSTOL capability vs . . . for JAST! So, if analyses such as this bomber study are to ultimately be helpful to decisionmaking, we must get to the campaign level, and we must get there reliably.

Furthermore, the framework within which we perform these reliable campaign level analyses must include some overall criterion, like "Get the most military capability for our money (or other constrained resources, like manpower)." In turn, military capability is defined by impact on overall ability to achieve military objectives over broad range of prescribed planning scenarios when all force elements of both sides are used to best effect toward achieving opposing objectives! This "Best Use of Force" is an internal criterion to be applied to the campaign analyses used in estimating military capability.



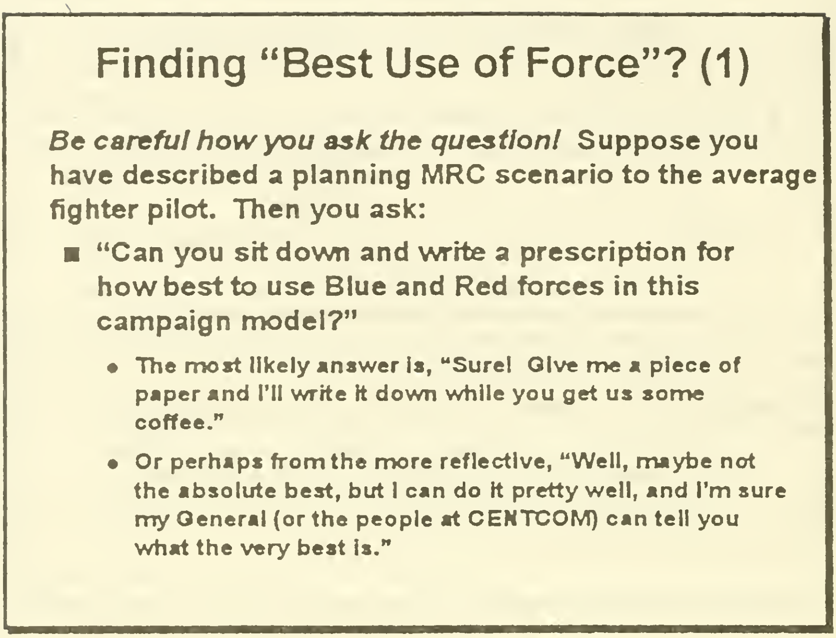
Why "Best Use of Force"?

- Logic of problem demands it.
  - *Can hardly make case for invoking "bad" ways of using forces. Would always like to know what can be done with what we have! (Same must also be true for Red.)*
- Kent's "Strategy to Task" framework demands it.
  - *"Model/simulation should include an "allocator" for both sides to determine best weight of effort over time among tasks and operational objectives toward achieving competing and opposing campaign objectives."*
- Acquisition directives (DoDI 5000.1/.2) demand it.
  - *"Mission needs must first be evaluated to determine if they can be satisfied by non-material solutions. Non-material solutions include changes in doctrine, operational concepts, tactics, training or organization."*

Figure 1 -- Why "Best Use of Force"?

There are lots of arguments for the internal "Best Use of Force" criterion to be enforced, including all these shown in Figure 1. It is very difficult to fashion much of a cogent argument against it.

However, there is a fundamental problem with the term "Best Use of Force". The phrase has a rather intuitive flavor that invites casual interpretation. On the one hand, this is a great strength when discussing the theory of resource allocation. The problem is that this casual interpretation invites everyone to think finding "Best Use of Force" in some way consistent with this casual interpretation is sufficient. Thus, practically everybody thinks they can find "Best Use of Force—at least close enough for government work" in any of a whole variety of ways. This mindset is illustrated in Figure 2.



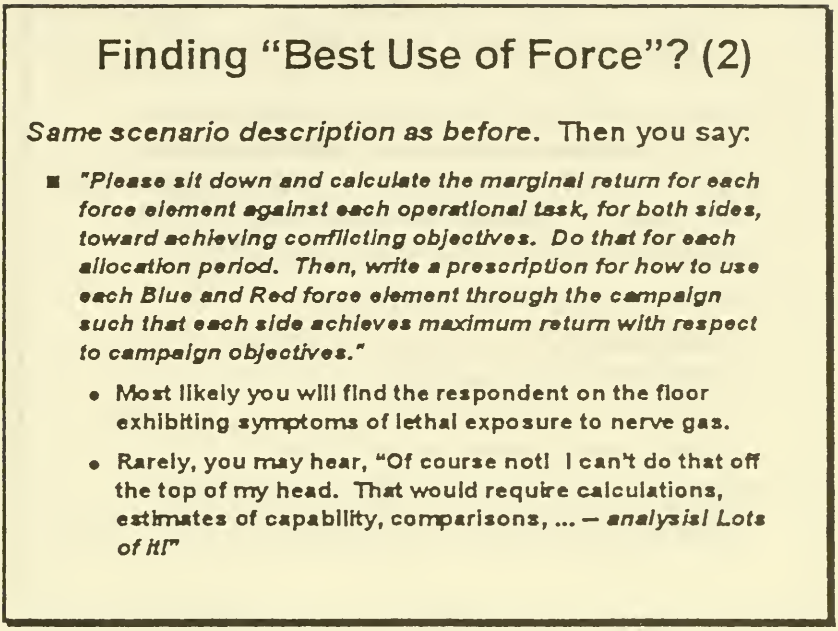
Finding “Best Use of Force”? (1)

Be careful how you ask the question! **Suppose you have described a planning MRC scenario to the average fighter pilot. Then you ask:**

- **“Can you sit down and write a prescription for how best to use Blue and Red forces in this campaign model?”**
  - **The most likely answer is, “Sure! Give me a piece of paper and I’ll write it down while you get us some coffee.”**
  - **Or perhaps from the more reflective, “Well, maybe not the absolute best, but I can do it pretty well, and I’m sure my General (or the people at CENTCOM) can tell you what the very best is.”**

Figure 2 -- One way to ask about how to use forces.

If you ask the question the way the structure of the problem and sensitivity of outcome to force allocation actually demand, as illustrated in Figure 3, then practically everyone can immediately grasp that the likelihood of finding “Best Use of Force” in any casual way is practically unthinkable.



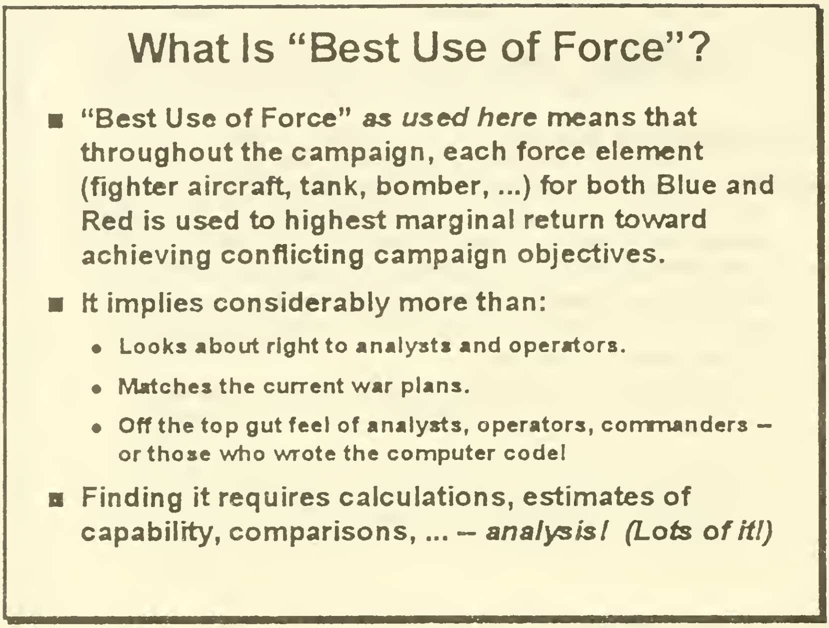
Finding "Best Use of Force"? (2)

Same scenario description as before. Then you say:

- ***"Please sit down and calculate the marginal return for each force element against each operational task, for both sides, toward achieving conflicting objectives. Do that for each allocation period. Then, write a prescription for how to use each Blue and Red force element through the campaign such that each side achieves maximum return with respect to campaign objectives."***
    - **Most likely you will find the respondent on the floor exhibiting symptoms of lethal exposure to nerve gas.**
    - **Rarely, you may hear, "Of course not! I can't do that off the top of my head. That would require calculations, estimates of capability, comparisons, ... — *analysis! Lots of it!*"**

Figure 3 -- A better way to ask.

The very un-casual interpretation of "Best Use of Force" is the operative one (Figure 4). Less casual interpretations to date have exhibited all the symptoms of chaos.

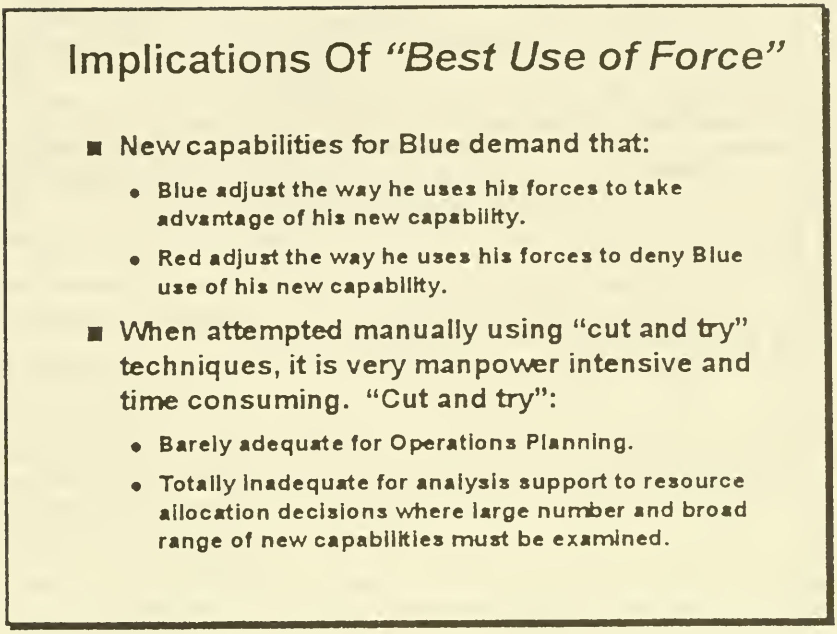


What Is "Best Use of Force"?

- "Best Use of Force" *as used here* means that throughout the campaign, each force element (fighter aircraft, tank, bomber, ...) for both Blue and Red is used to highest marginal return toward achieving conflicting campaign objectives.
- It implies considerably more than:
  - Looks about right to analysts and operators.
  - Matches the current war plans.
  - Off the top gut feel of analysts, operators, commanders -- or those who wrote the computer code!
- Finding it requires calculations, estimates of capability, comparisons, ... -- *analysis! (Lots of it!)*

Figure 4 -- What does it really mean?

Finally, there are two very prominent implications of strict adherence to the "Best Use of Force" criterion (Figure 5). First, "Best Use of Force" implies that both sides may in principle change the way they use all their force elements whenever either side comes to possess a single new capability!



Implications Of *"Best Use of Force"*

- New capabilities for Blue demand that:
  - Blue adjust the way he uses his forces to take advantage of his new capability.
  - Red adjust the way he uses his forces to deny Blue use of his new capability.
- When attempted manually using "cut and try" techniques, it is very manpower intensive and time consuming. "Cut and try":
  - Barely adequate for Operations Planning.
  - Totally inadequate for analysis support to resource allocation decisions where large number and broad range of new capabilities must be examined.

Figure 5 -- What are the implications?

Second, in view of the observation that the numbers of combinations of ways of using the forces of both sides in a moderate scale conflict of any duration literally exceeds the estimated number of elementary particles in the universe, the "cut and try" approach has limited potential for resource planning analyses to say the least.

The second implication in Figure 5 comes with a very strong caution. It does not, repeat not mean that there is no critical role for human operators in the process. What it does mean is that there are things that human beings cannot do well (like do extraordinarily long and complex strings of arithmetic in their heads with the speed of summer lightning), and there are things that computers cannot do at all (like, create new systems concepts or new concepts of operation, and decide whether they are sufficiently promising to even put on the menu!) This implication argues for demanding strong, expert human involvement in the creative part of the process, and leaving the calculation drone work to computers which do it better anyhow. It does further demand that you use machinery that directly and correctly address the primary determinant of campaign outcomes—how the forces are used. Otherwise, you'll drive the humans crazy and still never know where you stand relative to the best you could do!

In summary, the most important feature of a satisfactory campaign level methodology is to adequately treat how the forces of both sides are presumed to be used. The real problem is that it is exceptionally difficult to get much beyond "cut and try" and "that looks about right" methods. The established formal mathematical criteria are very difficult to meet on problems of sufficient size and realism that they are useful in decision making.

Most who have experience in campaign analysis are aware of the importance of how the forces are assumed to be used, but are limited by the tools immediately at hand and the time available to perform the analysis. Some are aware of the huge difficulty in finding "Best Use of Force." Jasper Welch, a long term colleague testifying today, is more acutely aware than most and in my experience has given the matter a far better and more comprehensive effort than most. Still, you may be aware that we disagree on the what constitutes adequate treatment of "Best Use of Force." I do not wish to diminish the seriousness of this disagreement, since seemingly small departures from established criteria can lead to quite large differences in estimated contributions of heavy bombers to campaign outcomes. Nevertheless, the disagreement between us pales in comparison with the disagreement I believe we both have with those who virtually ignore the subject, or fail to meet the standing specifications for "Best Use of Force" by a wide margin. The analysis methods available to IDA and used in this analysis fall into that category.

Does this mean that important lessons cannot be gleaned from analyses using methods that fail to meet "Best Use of Force" specifications? No, of course not. Jasper Welch has consistently made the point that intensity in combat, particularly in the opening phases is crucial to the outcome. It is a point which our analyses would suggest is critical, yet a point which seems not to have been prominent in the IDA analysis. The IDA analysis appears to have concluded that:

1. if we can get enough fighters in place before the war starts, bombers are a lot less important than if we can't,
2. if we can't get fighters in place before the war starts, bombers that can get there are more effective than fighters that cannot, and
3. neither fighters nor bombers are worth much unless equipped with adequate supplies of munitions that can hit something and destroy it.

These latter are important observations to be sure, but these are the relatively easy ones.

My best judgment is that such methods as were used in the IDA analysis are quite inadequate for performing the broad tradeoffs that I thought were to be a part of the bomber study—trades of bombers of each type for carriers, fighters, defense suppression and other assets that overlap bombers in function to some degree, yet provide disparate capabilities as well. These other assets also come with their own set of advocates—their own constituencies. For these trades, the rigor of a consistently applied criterion must be maintained. Absent methods that can efficiently meet the "Best Use of Force" criterion, more smoke, noise, and incessant argument among services or constituencies will be generated than light shed on the subject. Absent such methods, you will have to activate several battalions of analysts just to get the work done, then convene yet another Presidential Commission to sort out what it all means when time runs out. But you won't be able to sort it out anyhow. The results will depend too much on what each constituency is predisposed to believe about force use, and which prescription favors what force element.

This would be a gloomy assessment were it not for one additional fact. There is hope. Persistence on this problem over many years has paid off so that a broad scoped campaign methodology will be provided for use by any government agency on problems involving broad tradeoffs that have been exceptionally difficult in the past. This methodology (called OME–IV) employs sophisticated mathematical search routines to find "Best Use of Force" for both Blue and Red forces from reasonably comprehensive menus of possibilities for each for force element. That methodology has been applied to the present problem of improvements to the bomber force and certain broad based tradoffs, and the results summarized in a paper which I have prepared for the record, "Effectiveness of Heavy Bombers in Major Regional Conflict."

Finally, I would make these observations relevant to the IDA analysis presented today.

1. The analysis is baselined around the non-interesting operating point of sufficient warning to get significant tactical air into position. Under these conditions, bombers are indeed helpful, but not nearly as crucial as if we have very little reaction time to get significant fighter forces in place.
2. The effectiveness of bombers is severely limited by presumed shortages of the right kinds of munitions. While it is clear that we simply must have adequate supplies of the right kinds of munitions, that should be a given, and the analysis should have looked at the effectiveness of all force elements when properly equipped and supplied with the right kinds of munitions, and should have counted how many were needed. Then, the buy of munitions should be adjusted to properly reflect the needs. In other words, the major decision has been confounded by the minor decision!
3. The campaign objectives for both sides may have been specified in the classified version which I have not yet seen. If so, it is not apparent in the unclassified version which I have seen. It is difficult to imagine how the primary measures of campaign outcome (losses) are related to a legitimate expression of campaign objectives. Hence, when the Department concludes that "The planned force can meet the national security requirements of two nearly simultaneous major regional contingencies (MRCs) for anticipated scenarios and reasonable excursions," it is difficult to understand exactly what is meant, and what might constitute the criterion for sufficiency.

Again, Mr. Chairman, thank you for this opportunity to appear here today.

Senator LOTT. With that, Mr. Chairman, I will turn it over to you.

Chairman THURMOND. Thank you very much, Mr. Chairman.

General Loh, the Senate Budget Committee has proposed a DOD budget equal to the administration's request. If that were to be the approximate level of DOD funding for fiscal year 1996, what would the Air Force have to give up to acquire more B–2s?

General LOH. Well, I have testified, sir, that given that level of budget and that allocated to the Air Force, we could not afford to procure additional B–2s without greatly emasculating the Air Force modernization program. So, therefore, we could not afford to procure additional B–2s unless there were some additional TOA budget allocated to the Department of Defense or to the Air Force. It is just not plausible, given our current budgets, to afford 20 more B–2s in the Air Force budget.

To answer your question directly, we would have to cancel a large number of our modernization programs and procurement programs that we already have invested heavily in and need with great priority.

Chairman THURMOND. Dr. Kaminski, in your letter to me of May 3, you stated that conventional mission upgrades to the B–1 are more cost effective than procuring an additional 20 B–2s. Has any of the discussion in review of the study today changed your recommendation?

Dr. KAMINSKI. No, sir, it has not.

Chairman THURMOND. You are of the same opinion still?

Dr. KAMINSKI. Yes, sir.

Chairman THURMOND. Have you and the General talked about this? It seems you are at odds on this, does it not? General?

General LOH. One can argue endlessly about assumptions, Senator, and in fact Dr. Kaminski was most gracious in allowing me to see the study early before it was released and I did point out that such assumptions with regard to warning time and the arrival of forces and the necessity to swing bombers and the fact that the bombers were located outside of the theater were assumptions that we ought to understand better and do some sensitivity analysis and excursions on. And he went back and did those, and that is some of the analysis that you see today.

I think in every case when you make the assumption more conservative, the role of bombers, particularly the B–2, does increase and particularly in the most severe case that Dr. Kaminski showed that if you frustrate TACAIR in a theater, the bombers make a significant contribution. His study acknowledges that. So, I think you have to look at this in context.

I have no quarrel with the conclusion of the study that says we ought to invest heavily in advanced precision guided munitions.

Clearly the study is very positive on the contribution of bombers. It says we need all three bombers. It says we need the B–2, all of the B–1s, and the 20 B–2s that we have and we need to upgrade them and invest in a significant upgrade of B–52 and B–1 bombers. So, there are some very positive outcomes that are in the study that I thoroughly agree with.

Chairman THURMOND. In other words, you two gentlemen are together in your thinking on this question. Is that it?

General LOH. Well, I think we are together in terms of given the assumptions made, the results of the study are as they are.

I come at this from the standpoint that we recognize the value of bombers to our national security, particularly in the sense that we are a home-based force and we have to deploy rapidly. We have to influence events around the world, and bombers make a very significant contribution to our Nation's defense. Perhaps they have been undervalued in some of the work that has been done in looking at all force elements of the services.

So, I am a strong supporter given the fact that I have to provide the forces to our unified commanders around the world. I am a strong supporter of the role of bombers particularly in the early days of a conflict in order to be able to fulfill our strategy which is to win quickly and decisively with few casualties.

I pointed out that numbers are important. Numbers of bombers are important and in my opinion we are a bit short in the numbers needed to perform this strategy with very high probability of success.

So, I do not think we are in disagreement about what the study covers, but I do believe that we——

Chairman THURMOND. I did not say you were in disagreement. I said you were in agreement, are you? You are in agreement more or less, are you not? Are you more or less in agreement?

General LOH. We are more or less in agreement with the study as the study was conducted given the assumptions made in the study.

Chairman THURMOND. Well, thank you both for your testimony. We appreciate your presence.

Thank you, Mr. Chairman.

Senator SMITH [presiding]. Senator Exon.

Senator EXON. Well, Mr. Chairman, thank you very much.

General and Mr. Secretary, welcome. I apologize to my colleagues and to you. I am managing a little matter called the budget bill on the floor and I have to get back over there, but this is so important.

I just want to say that as you both must know from talking briefly to my colleagues and listening to the questions just asked by the Chairman of the committee, notwithstanding the restudy of the whole issue, which I think was an initiated by this committee—and I have not had a chance personally to take a look at what has happened or the restudy—there is great skepticism here on this committee.

We recognize that the military are under rather stiff constraints with regard to a whole series of matters, mainly not enough money to go around.

My first general question to both of you would be that if we had more money in the area of $10 billion, let us say, a year for the next 3 years in the overall military budget, would you both think that under that kind of a scenario that likely the first use of that money, if it were available, would be for more bombers? I suppose I will start with you, Mr. Secretary.

Dr. KAMINSKI. I would spend the first piece of that money on more munitions for the bombers.

Senator EXON. More munitions?

Dr. KAMINSKI. More munitions for the bombers and the tactical air, and I would have to look at it more carefully in terms of looking at that mix, but I doubt that I would spend all $10 billion per year on munitions. So, there are other pieces of the forces that I would be looking at, Senator Exon, to include in that situation additional B–2s, with that kind of additional money.

Senator EXON. General, could you answer that question from your perspective?

General LOH. In terms of a priority order, if we were given additional budget, what we would use it for would be to first shore up the F–22 program which incurred a $200 million cut last year, and we would buy a few F–15Es and F–16s in order to be able to maintain our force structure of 20 fighter wing equivalents out to the year 2005. We would fund a replacement for the tri-service standoff attack missile because of the importance of providing a standoff missile capability, particularly for the B–2, and we would fully fund all of the bomber upgrades that we have been talking about this afternoon. So, those are priorities that we would look at.

Senator EXON. Even before ordering more B–2s?

General LOH. That over additional B–2s, yes, sir.

Senator EXON. Well, that gives me great cause for concern. I am sure that there is a lot of pain and suffering going on inside the military today.

Dr. Kaminski, let me ask you this to try to focus in on this a little bit more. One of main measures of merit in the bomber study is the number of aircraft lost during the campaign. Why does the study not also include estimates of major equipment losses and casualties to the friendly ground forces? Surely ground force casualty would be in much larger numbers than the aircrew losses. It seems to me that that may be a shortcoming of the study. Could you explain to me why my concerns are not well founded?

Dr. KAMINSKI. We have some ability to make estimates on casualties. It requires the use of one of the special models. I would say our experience shows that those estimates are not very reliable in an absolute sense. They may be useful to make some comparisons among the various combinations, but my understanding is that we have only extracted that information from one of our models for a small number of the overall excursions that we have run.

Senator EXON. Well, given that, Doctor, is it not also true that air combat simulations are also considered to be unreliable to a large extent by the analytical community? Were not the Desert Storm calculations of aircraft losses as erroneous as the ground force projections? Is that not true? Is that a concern to you?

You answered my question by saying that you are not sure that the ground forces losses are very reliable. Is it not also true that at least in the Gulf war our air combat simulations were not very reliable either? It would seem that one would negate the other to me.

Dr. KAMINSKI. Perhaps our air forces were more reliable than our estimates of the ground casualties in the Gulf. I would offer for you, if you are interested, a look at what the air loss rates look like in this assessment and compare those to the Gulf results, and you will find that they are not significantly at odds.

Senator EXON. Well, I would simply say that when we keep reviewing all of these things, we cannot get too much tied up in some of these analytical propositions. Possibly we are not focusing on what are we willing to lose. That has to be a major consideration, and it is a major consideration of this committee, and maybe, whether we can stop the enemy short of the major objectives like if they would decide to go after Seoul or the Saudi oil fields.

I guess what we are concerned about here is the lack of what we anticipate and believe maybe wrongly—that is why we are pressing you on this—as to whether or not we maybe have not looked at not well thought out propositions of surprises, and we might find ourselves woefully short. I believe that it was you that said, General, something to the effect that in the early stages of a conflict, bombers are particularly important, and at the early stages of a conflict, at least this member of this committee still has some major concerns about that.

Can you do anything to allay my fears or concerns in this area?

General LOH. Well, I agree with you, Senator, that the contribution of bombers, because they provide a sense of immediacy and large range and payload, their value is particularly important in the early days and weeks of a conflict before you have a chance to deploy a lot of the other forces into the theater. We must go about attacking those strategic targets and starting to tear the air defense system and stemming the flow of forces into friendly territory as well as achieving air superiority with fighter aircraft so that we can allow for the arrival and the effective contribution of all of the other force elements. So, bombers and air superiority fighters are critically important in the first couple of weeks of combat.

I think this is an important point because our two-MRC strategy depends on us winning quickly and decisively with few casualties, and if you do not start out right and start out with an effective force and halt the invasion and then provide the introduction of TACAIR to build up your forces and then mount a counteroffensive in a matter of weeks, then you have much greater difficulty later on.

So, those first 2 or 3 weeks of a future conflict in this modern MRC situation are very important and we ought to think a lot about how we are going to do that and deal with the logistics flow, the quantities of systems that we have, the availability of munitions, and all of that. So, we are doing a lot of modeling both in the Pentagon and out in the field on how best to deal with those critical first few weeks of a conflict, and bombers make a significant contribution.

Senator EXON. One last question, Mr. Chairman.

Dr. Kaminski, I understand from my colleagues that were here that you did not show the slides on the FEBA movement in either of the Korean or Middle East cases. Is it not the case that FEBA movement for all four cases are virtually indistinguishable from one another, whether we have 20 or more B–2s or 95 fewer B–1s? Do you have and can you show us charts in this area?

Dr. KAMINSKI. Yes, sir. I do have that chart and I did show it.

Senator EXON. Has that been shown? Maybe it has been.

Dr. KAMINSKI. Yes, sir. Your conclusion is correct, though, that the movement was indistinguishable.

Senator EXON. Has that chart been shown?

Senator NUNN. I knew about it. I have not seen it.

Dr. KAMINSKI. We can put it back up, Senator Exon.

Senator EXON. Well, if it has been shown——

Senator NUNN. I wanted to ask General Loh whether he agreed with that.

Senator EXON. Let us put that chart up, if you could please.

Dr. KAMINSKI. Chart 14. On the left, Senator Exon——

Senator NUNN. It is the map of Kuwait and Korea that we wanted to see. That is another chart I think.

Dr. KAMINSKI. It is a classified chart.

Senator EXON. Is that a classified chart?

Dr. KAMINSKI. This chart is not classified.

Senator EXON. But the one I am requesting is?

Dr. KAMINSKI. This shows the movement in terms of depth of penetration, and to make it unclassified, the length of the blue bar I have just set at 100. That is what happened in the baseline situation with all of our assumptions, all of our forces. The hatched bar shows what happens when you add an additional 20 B–2s, and there is not a significant difference in the FLOT movement. There is some difference in the number of aircraft lost and the number of sorties required.

Senator EXON. Do you interpret that chart in that fashion? What do you think of it, General Loh?

General LOH. Well, in the first week or 10 days of a conflict, the contribution of the B–2s would be to attack strategic levels of targets and armored brigades and start to tear down the enemy's air defense system. So, we ought to be looking at more than one measure of merit and measure of effectiveness. This is one measure of effectiveness. There are many, many more that the study perhaps looked at. So, you can draw one conclusion from this chart, but it depends upon how you employed those 20 additional B–2s.

If the strategy showed that it was more important to start taking out the strategic level of targets over deep in enemy territory, which is what the B–2 can do very effectively, in order for the non-stealthy TACAIR and non-stealthy bomber forces to be used more effectively at halting the invasion, then the movement of the forward line of troops may not be that important. I just do not know what the control logic in the model was on the employment of those 20 additional B–2s.

I would use them to take out the heart of the enemy's air defense system and strategic level targets, Scud targets, those critical targets that if you do not take out in the first few days can cause tremendous losses to you and prevent the arrival of forces that could deny ports and lay mines and do those sorts of things.

So, this is a complex subject. To use a single measure of merit to show the contribution of B–2s is not complete let me put it that way.

Dr. KAMINSKI. And if I may add to that, Senator Exon, you do see a bigger difference in the other parameters. The B–2s were used, as General Loh described, and so you see some impact on aircraft lost.

I would also say that our snapshot here is at the end—for example, aircraft lost and sorties required. It is the end of the campaign.

You see that the bombers have a bigger effect during the early piece of the campaign, just as General Loh was saying, that before TACAIR is arriving in numbers, the bombers have a much bigger effect early on. That effect becomes swamped over time as the other forces begin to arrive.

Senator EXON. Mr. Chairman, thank you very much.

Thank you, gentlemen.

Senator SMITH. Senator Nunn.

Senator NUNN. I just wanted to ask one final question. General Loh, I understand while I was out of the room you mentioned the priorities of the Air Force, and I believe Senator Exon asked you or Senator Smith, if you had additional money, what would you do with it. Could you repeat that?

General LOH. Yes, sir. If the Air Force were issued additional budget for 1996 over our current program, we would restore the cuts that were taken to the F–22 program. We would buy a few more F–15Es and F–16s, not to increase the force structure but to ensure that we can maintain the 20 fighter wing equivalent force structure beyond the year 2000. We would invest in a replacement for the tri-service standoff attack missile, the son of TSSAM, and we would fully fund all of the bomber upgrades so that we achieve the improvements to the bomber force in the conventional sense that we have been talking about this afternoon. Those have a high priority.

Senator NUNN. Is that your personal list also? If I asked you what is your personal view of the priority, where would the B–2 fit in on that list in your personal view?

General LOH. Senator, I believe the B–2 fits in a different category. If we are going to commit to additional B–2s, we have to make a commitment to fund the additional 20 over a long period of time, and that is a significant impact year by year, some $2 billion to $2.5 billion probably depending upon the production rate of the B–2. So, I put the B–2 in a different category.

Senator NUNN. But if I told you we had $2.5 billion additional for the next 10 years, would you tell me that you would rather have additional F–15s and F–16s—your personal view—than to buy B–2s?

General LOH. Well, I do not think F–15s or F–16s would take that much money so that you could probably, if you were committed to that and we could be assured of that much additional budget, we could buy the F–15s and F–16s that we are talking about and the B–2s as well, if it is that large an increase.

Senator NUNN. But your personal view is additional F–15s and F–16s now have a higher priority than trying to buy additional B–2s.

General LOH. We are talking about 18 F–15Es. So, it does not represent that significant an amount of money. And we are talking about a total of 50 or 60 F–16s over the next 5 years. So, it is not a very significant amount, but it does mean a lot to me because right now I am short of F–15Es and my ability to train and operate the existing force that I have.

Senator NUNN. General, have you seen that Air Force effectiveness chart up there about what the B–2 does compared to F–15s and F–16s?

General LOH. Yes, sir.

Senator NUNN. And you still would put additional money in F-15s and F-16s?

General LOH. I do not think bombers alone replace the entire fighter force structure.

Senator NUNN. No, but I mean——

General LOH. I believe we do need 20 fighter wing equivalents, and I think that is a minimum force. In fact, in the scenario here we have to swing some of the fighters from one war to another. So, I am spread pretty thin at 20 fighter wings. I will say that as we replace fighters in the future, we ought to buy stealthy fighters because of the advantages that you show.

Senator NUNN. Well, I agree with that. Out of our inventory of F-16s, what percentage of them did we use during the Persian Gulf war?

General LOH. I do not have a specific number. We used a large amount.

Senator NUNN. I think it was about 20 percent.

General LOH. The ones that we did not use were primarily in the Guard and Reserve forces.

Senator NUNN. I think about 80 percent of the F-16s were never even sent to the theater.

General LOH. We had a much larger force structure back in those days, Senator Nunn. A lot of those F-16s are not there anymore. We have more F-16s in the Guard and Reserve than we have on active duty now.

Senator NUNN. Well, does that mean they are not available?

General LOH. No, sir. They are available but they are available a little later and with a little less capability than the active duty force structure.

Senator NUNN. Well, you will get some quarrel on that.

General LOH. I said a little. It is marginal. [Laughter.]

Senator NUNN. Well, I have a hard time fathoming that you would rather have more F-15s and F-16s now than B-2s. I cannot really decipher that.

General LOH. Again, Senator, I put the two in a different category.

Senator NUNN. You want the B-2 to come out of somebody else's budget, not the Air Force budget. [Laughter.]

General LOH. Not somebody else's budget, sir. I think the Nation ought to decide whether or not it needs more B-2s and then fund it as a national program.

Senator NUNN. But that is somebody else's budget rather than the Air Force. I agree with that, but that is what you are saying, is it not?

General LOH. But I do not say that you should raid the Navy or Army budget to do it either.

Senator NUNN. Well, where is it coming from then? More Medicare cuts? [Laughter.]

Senator SMITH. Let me just ask one final question, gentlemen. I do not think there is anybody that disagrees that 20 B-2 aircraft is a pretty thin margin based on the possible threats that we face. General or Mr. Secretary, when you get to a certain point, how many aircraft do we have to drop to where we say, whoops, we have to open up the line, if we could do it, which we cannot?

Suppose through attrition we lose 10, 9. What is the number when we cannot function and we need more B–2s?

General LOH. Well, we are not going to lose 9 or 10 through peacetime attrition. If you do, you ought to fire me tomorrow because we expect——

Senator SMITH. Let me tell you something. I do not know about that. You get two-MRCs on your hands at the same time——

General LOH. I was talking peacetime attrition.

Senator SMITH. Well, we would not need any aircraft if we are going to talk about peacetime all the time. We are preparing for a threat.

General LOH. Sir, to your point, I believe your point is a good one in that if bombers are important to our Nation, we ought to have an acquisition strategy for bombers that looks to the long term. We pointed out the fact that we have been flying B–52s for over 30 years, and unless something else happens, they will be flying for another 30 years. B–1s will attrit over time and B–2s will attrit over time.

Senator SMITH. And the line will be gone.

General LOH. And the line will be gone. So, one ought to think about the consequences of that and look at a long-term acquisition strategy, a sustained, low rate acquisition strategy, for these kinds of systems that are very costly to procure and even more costly if you had to start over again.

Senator SMITH. So, there is no number, so-called drop dead number, where we would be in jeopardy? How many below 20 can we go?

General LOH. Well, as I said, the number 20 came about because it was the minimum number that we could field a significant operational capability. So, if you drop much below 20 in terms of losses, then you are back to the point where the B–2 is not going to be nearly as effective in a major regional conflict and could be used for crisis and one-time raids and minor LRCs. But that does not utilize the value of the B–2 as effectively as it is in a major regional conflict where its survivability and stealth features are paramount.

Senator SMITH. That last point. I do not want to belabor it. It has been a long afternoon. I am just trying to get you to indicate to me if we lose one aircraft, two aircraft, are we in trouble as far as minimally what we need for stealth bomber aircraft.

General LOH. If we lost one or two B–2s, we would still have a significant capability.

Senator SMITH. Thank you very much, Mr. Secretary and General Loh.

I will announce before we adjourn that I am going to leave the record open until the 22nd in case any member has any further questions and give you until the 26th to respond if they are asked. I do not want to make it any longer than that because the budget process is moving along pretty rapidly.

The hearing is adjourned.

[Questions for the record with answers supplied follow:]

QUESTIONS SUBMITTED BY SENATOR TRENT LOTT

Senator LOTT. Dr. Kaminski, in your letter to the Chairman of the Senate Armed Services Committee, you recommended against the acquisition of any further B–2 bombers. How confident are you that the necessary precision munitions will be developed and acquired by DOD?

Dr. KAMINSKI. The acquisition of additional precision weapons is one of the Department's top modernization efforts. The recently completed Heavy Bomber Study provided additional evidence of the effectiveness of precision weapons as a force multiplier. I have initiated a follow-on study to determine the cost-effective quantity and mix of future weapons. The President's budget supports this increased emphasis on precision weapons, and the Department will continue to investigate opportunities to speed this modernization effort.

Senator LOTT. Dr. Kaminski, you state in your letter that you plan to reevaluate the decision to allocate funds for preserving the B–2 production base and may instead reallocate those funds to weapons and conventional upgrade programs. Wouldn't the Department of Defense require congressional approval to reprogram those funds?

Dr. KAMINSKI. I have not yet completed my evaluation of that initiative. Where required, the Department of Defense would request congressional approval prior to reprogramming funds.

QUESTIONS SUBMITTED BY SENATOR SAM NUNN

Senator NUNN. Dr. Kaminski, even if I believed the deployment rate assumptions used in the Bomber Study could be met, this would simply compound the problems of logistics resupply. As we saw in Desert Storm, the first week of the air war turned Saudi Arabia into an importer of POL products, just to support the air war. Your study also recommends doubling the stocks of advanced precision munitions. With only 5 or 10 days between C-day and D-day, and the huge flow of forces you assume reach the theater in that interval, how do you bridge the 3- to 4-week gap until the sealift link from CONUS is established, along with the rear-area distribution system? Was any of this actually modeled in the study, or are we asked to take logistics sufficiency as another given?

Dr. KAMINSKI. We used the services' logistic planning factors in the Bomber Study. Based upon our experiences in Desert Storm and other military operations, we have made investments in the logistic support area, and we would expect our logistic support capability to continue improving in the future. The congressional direction for the bomber study required us to evaluate scenarios for the years 1998, 2006, and 2014. A combination of airlift, preposition supplies, and in-theater assets would provide needed supplies until the sealift link could be established.

Senator NUNN. Dr. Kaminski, we note that the Bomber Study's analysis is based on MRCs in Korea or Iraq. Yet the BUR report clearly states that these scenarios should be viewed as "planning tools," not forecasts. The U.S. undoubtedly is going to be concerned about changes in the next century among the nations of the former Soviet Union, Russia, China, and other states in the heartland of Eurasia. Did you test the capability of this force to assist U.S. foreign policy in a crisis in these areas, such as in the Ukraine or Kazahkstan, far from the oceans and lacking in infrastructure for tactical forces. Wouldn't scenarios like these also highlight the need for more bombers?

Dr. KAMINSKI. It is important to realize that the Bomber Study used the two scenarios as planning tools and not intelligence forecasts. Using those two scenarios ensures consistency with the Defense Planning Guidance (DPG) and the Bottom-Up Review (BUR). The 1995 Heavy Bomber Force Study is the most comprehensive analysis performed to date, using available data on these two proposed MRCs. The choice of these locations also takes into consideration baseline scenarios used in at least 18 previous commercial and government studies. While other situations can, and may, develop in other parts of the world that may stress particular segments of the force structure, the Bomber Study was designed to evaluate the effectiveness of the bombers as part of a total force package. It would be conjecture to predict the contribution of bombers or other weapons system in other scenarios without performing substantial analysis of available force alternatives.

Senator NUNN. General Welch and General Goodson, you are both highly-regarded as military analysts, and I assume you have both had an opportunity to review the Bomber Study. Let me ask you to answer the following:

Does the Bomber Study provide the Congress with an adequate assessment of "bomber requirements?"

General WELCH. In my professional judgment the Heavy Bomber Study in its current form misses by a wide margin.

General GOODSON. No. It rather dramatically underestimates the contributions of properly equipped (weaponized) heavy bombers in major regional conflict scenarios of the "cold start" variety, that is where we have not reacted in time to have substantial numbers of fighters in place when the conflict begins.

To vastly oversimplify, my impression is that the Congress asked whether, in the broad context of major regional conflict, more bombers should be bought in lieu of some of the other major force elements. The answer provided by the DOD Bomber Study is that, within the rather narrowly defined confines of the "not-really-cold-start" scenario examined, poorly weaponized heavy bombers contribute so little to our overall force effectiveness that we don't even need to examine trades any further—though spending some money to properly weaponize heavy bombers appears to be a good buy.

While I believe that practically any analysis performed within the same narrowly defined conflict situation would yield similar results, I believe the conflict situation used by the Bomber Study is far too narrowly defined to provide a firm analytical foundation for deciding which major force elements to fund.

Senator NUNN. If not, are the failings due to the way the study was structured, or the assumptions used, or both?

General WELCH. There are sufficient failings in both the structure and the assumptions to render the study untrustworthy for the Congress. Since that is such a strong judgment, perhaps I had better provide some examples.

First, the study uses a fully warned variant of the "two MRC" scenario as the baseline scenario over the next 20 years. Over that period of time we should expect many other scenarios with substantial plausibility and high probability. Moreover, *only* this variant scenario could produce most the conclusions of the Heavy Bomber Study.

Second, the study uses the combat capability of some $150 billion worth of new tactical aircraft as part of its baseline, but totally obscures the cost of these aircraft. Long ago, I learned that a good study should display the costs of *all* equipment whose capabilities are used.

Third, the study artificially constrained the utility of all bomber forces by (a) choosing bomber sortie rates below Desert Storm actuals, while crediting fighters with rates well above Desert Storm actuals, (b) maladroit basing schemes and (c) so constraining the weapons inventory such that bombers could only get weapons by taking them away from tactical forces.

Fourth, the study assumed that the B–1 ECM will continue to be highly effective for 20 years. To my knowledge, the DOD has never before relied on ECM effectiveness over such a long period. Stealth was pursued in large part because of the past judgment that the ECM–ECCM game is highly unpredictable and unreliable.

There are many other difficulties with the study, as outlined in my prepared statement, but these four give some of the flavor the deep difficulties with the study. Nonetheless, as I stated in my prepared statement, I am confident that the IDA study group is quite capable of correcting these deficiencies. I urge this committee to request the appropriate changes.

General GOODSON. Both. The major difficulties with *assumptions* are:

(1) While I am not familiar with the classified details of the threat, I conclude from the behavior of the analysis output that the threat used in the study is relatively small, particularly the air component—perhaps on the order of 400–500 fighter aircraft, and with ground component on the order of 1,500–2,500 tanks with associated equipment. Certainly analyses should start a with "validated" threat, and I'm sure this one was. On the other hand, it seems to me that prudent planning should at least examine the consequences of some determined opponent spending on the open market the reasonably modest sum necessary to double or even triple the above. Even if there is no evidence within the intelligence community of any potential opponent actually making such a move at this time, in view of the ease and modest cost of reaching force levels that could cause us real problems, analyses supporting prudent planning should determine the best course of action on our part to discourage such a buildup to begin with and to thwart it if it should happen. Then, the administration and the Congress would have the real ingredients necessary to make an informed political decision on whether the reduced risk is worth the money.

(2) The baseline also assumed that we would react in time to get a large number of fighters in place before the beginning of the conflict. The fact that it happened that way the last time we actually went to war should be small comfort since when the conflict actually begins is largely under enemy control—not ours. I believe we will be quite fortunate if future enemies do not go to school

on our last war in the Mideast. If they do, then not waiting till the united States and our allies have built up to overwhelming strength must surely be at the top of the list of lessons.

(3) The baseline for the analysis of the usefulness of heavy bombers in Major Regional Conflict (MRC) assumed heavy bombers equipped with essentially today's weapons. It has been known for some time that heavy bombers so equipped are practically useless in conventional conflict. Hence, the result that bombers so equipped would have little impact should come as no surprise. It has also been known for some time that an exceptionally inexpensive cure is to equip heavy bombers with JDAM and a guided cluster munitions dispenser, and that such a cure transforms heavy bombers from "practically useless" to having far greater impact in "cold start" MRCs than any other force element—and second place isn't close! Given the small (and planned) expense of properly equipping heavy bombers with the right kinds of munitions, the analysis should have used "properly equipped" (i.e. properly weaponized) heavy bombers for the *baseline*, rather than finding as an *excursion* that sufficient quantities of the right weapons are very important to the success of heavy bombers.

The combined effect of these three assumptions (low threat, large U.S. fighter buildup before conflict begins, and heavy bombers being very poorly equipped for conventional conflict) is quite predictable. In this type of conflict, we might just as well leave the heavy bombers home. We can handle that situation quite nicely without any heavy bombers at all. However, if we reverse these three assumptions, the situation without heavy bombers is very likely to be a disaster for our interests. Properly equipped heavy bombers in sufficient quantity can turn that disaster into a reasonably tractable situation. The first step is to equip the heavy bombers we already have with proper weapons, and that gets us most of the way home. The cost of the first step is almost negligible compared to other, far less effective steps we are taking in defense. The cost of further reducing risk through purchase of additional B–2's or better standoff weapons for B–52, or both, is certainly non-negligible, but still a far better buy for this class of conflict than other purchases we are contemplating.

The major problem with the *structure* of the analysis is that it did not cover the trades among the major force elements originally chartered in the legislation—trades among land and carrier based fighters, C–17 etc.

Senator NUNN. Are the measures of merit used in the study both adequate and appropriate?

General WELCH. In my judgment the measures of merit used in the Heavy Bomber Study cannot provide valid insight into the two questions that are before the Congress: What is the most appropriate budgetary balance between aircraft and aircraft weapons? What is the appropriate balance between bombers and tactical aviation? Both questions should be answered considering the plausible and probable range of future threats to our national security, not just considering one specific scenario.

By present plans and programs the DOD would have more than 90 percent of the budget for aircraft versus weapons and more than 90 percent for tactical aviation versus long-range bombers. Secretary Kaminski has today announced that he is going to re-examine the balance as between aircraft and weapons. I urge this committee to insist that the DOD re-examine the balance as between tactical aviation and bombers. The Heavy Bomber Study in its current form does not do a decent job on either of these major budget issues.

General GOODSON. No. The overall or controlling measure of outcome for major regional conflict should be very closely connected with achieving overall campaign objectives. Since the overall campaign objectives are typically expressed in terms of territorial objectives gained and held, it would seem at first glance that FLOT movement might be a good measure. However, the U.S. Army's CAA has found that the distribution of movement rates is exceptionally broad, and that FLOT movement alone, without some accompanying estimate of risk that the enemy will achieve his objectives, means very little.

For example, suppose that we interpret the FLOT movement profiles of the bomber study to represent the 50th percentile—meaning 50 percent of the time the enemy will get at least that far into friendly territory. Let's say that there is little or no movement at the 50th percentile. Still, the enemy will be able to get further with some lower probability.

To know whether we ought to feel comfortable, we need to be able to estimate the risk that the enemy will be able to achieve his objectives within our specified reaction time. If, for example, our best estimate were that he has less than a 1 percent chance of securing the ports and oil fields before we can offload significant material by sea, then we might feel rather comfortable. On the other hand, if our best estimate of the risk is 30 percent rather than <1 percent, then the United States probably would not want to make a large military commitment unless the consequences of not doing so were very dire indeed. At a personal level, it would take a very large incentive to cause me to walk across the street if I though there were as much as a 1 percent chance of being run over and killed—much less 30 percent. In other words, the military instrument would not be useful in those circumstances. As you have seen from my paper on the subject, our estimates for some reasonable scenarios are that the risk is closer to 30 percent than to <1 percent. The Bomber Study does not address this, so it is quite difficult to interpret the rather static FLOT movement results at what I must presume to be the 50th percentile on risk.

Having observed little or no sensitivity to FLOT movement, the analysis then defined a set of air-to-surface targets to be serviced, and minimized aircraft losses in the servicing of them. While minimizing aircraft losses is an important thing to do, it must be secondary to achieving the campaign objectives—otherwise we would have stayed home. The imbedded presumption is that if we service the prescribed set of targets, then we will have achieved our objectives. This is a tenuous connection, and very difficult to establish with much reliability.

Senator NUNN. Dr. Kaminski, the heart of your argument seems to be captured on a chart from your unclassified briefing, labeled "Cost-Effectiveness." As I understand the term "cost-effectiveness," that is defined as follows:

Force A is more cost-effective than force B, if, and only if, (1) both forces have equal costs, and force A is more effective than force B, or (2) both forces have equal effectiveness, and force A costs less than force B. Yet, on this chart, I see neither equal-cost forces compared, nor equal effectiveness forces compared. On what basis do you claim this is a "cost-effectiveness" example?

Dr. KAMINSKI. Cost-effectiveness is a relative term. A cost and operational effectiveness analysis (COEA) evaluates the costs and benefits of alternative courses of action to meet recognized defense needs. Alternatives are evaluated in terms of their marginal costs and benefits against each other, or a given fixed alternative, such as the status quo. It is not necessary that the cost or effectiveness of the alternatives be equal. For example, if Force 2 cost $1 billion less than Force 1 and Force 2 was more effective, Force 1 could be considered less cost-effective, even though we did not make comparisons on the basis of equal cost or equal effectiveness.

Senator NUNN. Dr. Kaminski, I understand that the bomber study assumes that all five carrier battle groups operate from the outset both in the Persian Gulf and off both coasts of North Korea in close proximity to the hostile shorelines. During Operation Desert Shield, the Navy would not allow carrier operations in the Gulf for weeks, due to the threat from mines. Have the Iraqis or the Koreans no mining capability in 2006 or 2014? How was mining treated in the IDA analysis?

Dr. KAMINSKI. The Bomber Study used the best available intelligence community estimates for threat capabilities, and service and Joint Staff planning factors for force arrival profiles, which included carrier arrivals. In some excursions, we simulated the effects of potential mining by the enemy. That action forced the carriers to operate from greater distances offshore until the mines were cleared.

Senator NUNN. General Welch and General Goodson, are you familiar with the draft report on future bomber forces which the Commission on Roles and Missions (CORM) is preparing at the request of the Congress? If so, please answer the following questions about the staff study:

Does the draft CORM study examine tradeoffs between bomber forces and non-bomber forces, unlike the IDA study?

General WELCH. I am familiar with the staff paper. It does perform some such trade-offs.

General GOODSON. Yes.

Senator NUNN. Does the draft CORM study find any cases in which additional B–2s appear to have greater effectiveness than roughly equal-cost non-bomber forces, unlike the IDA study?

General WELCH. The staff paper does show some such cases.

General GOODSON. Yes.

Senator NUNN. Is the structure of the CORM staff study more amenable to understanding potential cost-effectiveness tradeoffs than the IDA study?

General WELCH. The structure of CORM staff study is much more open to understanding.

General GOODSON. It appears to be, simply because it at least addresses the question of tradeoffs, in contrast to the Bomber Study which did not. However, I believe that appearance is illusory. The overly simplistic methods and measures used in the CORM study seriously overestimate the contribution of stealth in comparison with non-stealthy assets (the primary funding source for more stealthy assets), and do not even attempt to account for the considerable synergism that exists between bombers and fighters of both stealthy and non-stealthy varieties. In my view, the problem with CORM effectiveness estimates is serious enough as to disqualify the CORM study as a serious vehicle for determining bomber force structure. The vector the CORM study suggests—more heavy bombers (equipped with the proper weapons) at the expense of fighters—is essentially correct, but how far to go in that direction requires analysis methods which can take the applicable synergisms into account.

Senator NUNN. General Goodson, your analysis and testimony suggest the need for more bomber capability, and you suggest that we consider either more B–2s or more long standoff weapons for B–52s, or possibly both. Your analysis apparently did not explicitly consider tradeoffs of more bomber capability for equal-cost reductions to less effective non-bomber forces. Based on your considerable expertise, do you believe there exist cost-effective tradeoffs of more bombers for less of some tactical forces?

General GOODSON. Yes. For "Cold Start" MRCs, there is little question that, after properly weaponizing the B–1 and B–2 bombers we already have, buying 20 to 40 more B–2 at the expense of two to four CVBG would result in a more capable and effective overall U.S. force at the same or less expense. Both carrier based and land based fighters are valuable in this type of scenario, but not as valuable in the initial stages as properly equipped heavy bombers. On the other hand, if we believe that we will never be faced with the "Cold Start" MRC, then we don't need any more heavy bombers. We need only to properly weaponize the ones we have. The problem with land based fighters is that it is difficult to get them there at the beginning of a "Cold Start" MRC. Carrier based fighters may be, but are not necessarily, somewhat better in this regard, but carrier air simply costs a great deal more than land based air. This observation of course leaves aside the question of other types of scenarios where the "presence" of carrier based air might be even more valuable.

Still, at this level, the question of the relative usefulness of more heavy bombers and fewer carrier battle groups can hardly be avoided in a serious debate on defense posture. The proper balance will ultimately depend on political judgments concerning what kinds of conflict situations we wish to prepare for, and how much risk we are willing to take in each in view of the cost of reducing that risk. Those judgments should rest on proper analyses of the best way of achieving desired performance in each, and the associated price tag.

Senator NUNN. General Goodson, your testimony portrays a situation in which the United States and its allies might be numerically inferior in both ground forces and tactical air forces in a potential Middle East scenario, and that, under some circumstances, we could lose both the air supremacy battle and the ability to halt the invading army on the ground. This is in marked contrast to the FEBA movement charts in the IDA Bomber Study, which shows virtually no territory lost and a quick "halting" of the enemy, whatever the level of bombers. In your view, what drives the stark differences between your projections that it could be touch-and go, and the results of the IDA Bomber Study?

General GOODSON. It is the combined effect of the three assumptions discussed at some length earlier. Initially reviewing the first two and their effects: (1) IDA bomber Study appears to be based on a smaller threat—proably lower on the air side than the lower boundary of the guidance contained in the Bottom-Up Review (500 enemy fighters) whereas the analysis results which I have presented are appropriate for the middle and upper bound of the BUR guidance (750 to 1,000 enemy fighters.) I also suspect that the ground force strength used in the IDA Bomber Study is significantly lower than the one I used, probably in about the same position relative to the BUR guidance. (2) The baseline of the IDA Bomber Study considered a large number of USAF fighters deployed and in place prior to the commencement of hostilities.

The bottom line of these two assumptions would be that in the IDA Bomber Study, friendly ground forces are probably outnumbered by only 2 or 2.5 to 1, but friendly fighter strength might be *higher* than enemy fighter strength by a factor of 2 to 3. In contrast, going to the middle to upper bound of the Bottom-Up Review guidance as my analysis did yields friendly ground forces being outnumbered by about 4 to 4.5 to 1, and with friendly fighter strength being much *lower* than the threat—by a factor of 2 to 3, and in the unfavorable direction!

Disregarding the effects of heavy bombers, these two IDA Bomber Study assumptions alone would lead to a fundamentally static FEBA at the 50th percentile, since Blue air can quickly defeat Red air and put a great deal of very effective air-to-surface effort on Red ground forces, which were already of marginally low strength to achieve meaningful ground objectives. If we then overlay bombers equipped with ineffective weapons (Bomber Study assumption 3) on a situation where the FEBA is not moving, it still does not move—proving only that if you already have overwhelming strength, adding little to it does still less.

The question then becomes, "Are there reasonable future circumstances in which potential enemy might be expected to present us initially with overwhelming strength, rather than the converse; how unfavorable are the consequences to our interests, and how effective are properly equipped heavy bombers in redressing those unfavorable consequences compared to other force elements that compete for funding?" Those circumstances are the one considered by my analyses. The reversed initial fighter strength ratio compared with the Bomber Study, combined with the somewhat greater ground force strength, lead to campaign dynamics and outcomes that are in sharp contrast to that portrayed by the Bomber Study. In this instance, disregarding the impact of heavy bombers, Red air can defeat the Blue inplace fighter forces (allied air and one CVBG) and greatly hinder further reinforcement. He may even spare a fair number of sorties to support his stronger ground forces, which now stand a fair chance of achieving their phase I objectives without air support, and an even better chance with some air support. The primary impact of properly equipped heavy bombers in turning this around is in helping destroy enemy air on the ground (along with enemy air defense surveillance and control elements) to gain air superiority. Then, reinforcement with more land and carrier based fighters is less problematic, and all friendly air elements can concentrate on attack of enemy ground units.

Senator NUNN. General Welch and General Goodson, earlier this month the Air Force sent over its list of priorities for the allocation of any "plus-up" funds that the Congress might find. Of the "Top 6" items on that list, the Air Force wants to spend $1.8 billion over the FYDP to buy additional F–15s and F–16s. In your view, would buying more non-stealthy F–15s and F–16s be more cost-effective than buying additional B–2 bombers?

General WELCH. No. That cost-effectiveness trade-off is relatively straightforward and definitely favors additional procurement of stealthy B–2 aircraft. Moreover, the additional B–2 aircraft would be effective in many plausible and probable scenarios wherein the non-stealthy tactical aircraft would not be effective. Such scenarios would have some combination of ambiguous warning, effective enemy air defenses and unavailability of suitable, secure air bases close to the enemy.

General GOODSON. No. I believe the opposite is true. But as I pointed out in my summary paper, before you get to either course of action, it is crucial to spend the money necessary to properly weaponize B–1 and B–2 for conventional conflict—and that includes buying *sufficient numbers* of the right kinds of munitions. That is more cost-effective than either of the above by a huge factor.

Senator NUNN. Dr. Kaminski, the terms of reference for the Bomber Study developed by Dr. Deutch called for the following: in Task 5, to develop blocks of non-bomber forces equal in cost to the cost of increased numbers of B–2 bombers; and, in Task 6, to conduct cost-effectiveness analyses among the various tradeoff possibilities identified in Task 5. Why have no such cost-effectiveness tradeoffs been analyzed?

Dr. KAMINSKI. The Heavy Bomber Study Executive Committee (EXCOM) grouped the study guidelines into the three study parts identified in the logic diagram appearing on Chart 3 of my statement for the record. The Task 5 and 6 non-bomber force trades were incorporated in the part three effort. The EXCOM agreed that these trades would be useful only if the military capabilities of additional bombers were required to achieve our national security objectives. In all the scenarios and excursions examined during the Part One Bomber Requirements Study (see Chart 3 of my statement for the record), we found that additional bombers were not required to achieve our military objectives. In many cases, additional bombers were useful, but we could achieve our objectives without them. For this reason, the EXCOM determined that the Part 3 study incorporating Tasks 5 and 6 was unnecessary and therefore was not performed.

Senator NUNN. Dr. Kaminski, in view of the widespread availability of precision weapons, do you assume that enemy tactical air forces could have by 2006 or 2014 a significant air-to-ground capability at any point in the campaign against U.S. and allied ground forces? Was any enemy capability to attack allied ground forces even included in the methodology used?

Dr. KAMINSKI. The enemy capability to attack allied ground forces was based on current intelligence estimates for 2006 and 2014. Baseline projected threats included enemy ground force growth and air defense modernization.

Senator NUNN. General Loh, in your personal view, if we terminate the B–2 program this year, will we have maximized the taxpayers' investment in stealth technology? Is 20 B–2s a large enough force to be operationally meaningful? Have we ever before bought a combat aircraft, a weapons-dropper, in such small numbers?

General LOH. The United States has invested $24 billion in stealth research and development. Terminating the B–2 program this year or stopping production after the planned buy of 20 is not maximizing the return on that investment. In my opinion, our Nation needs to consider a long-term, sustained, low-rate acquisition strategy for our bomber force. Such a strategy would take full advantage of our investment in stealth technology and provide an incentive to keep this crucial technology advancing. Moreover, a commitment to a low-rate acquisition plan would allow us to sustain and modernize the bomber fleet more economically than a large purchase every 30–40 years.

A B–2 force of 20 is large enough to be operationally meaningful, but it is the minimum number necessary to provide a small but sustained operational capability.

We have never bought a combat aircraft in such small numbers as the B–2.

Senator NUNN. Dr. Kaminski, one problem with the strategy embodied in the Bomber Study is its dependence on timely warning and reliance on massive deployments at first warning. Last October, when Iraq moved troops south, we made a much more limited, and slower, deployment in response, but even that modest deployment reportedly cost between $500 million and $1 billion—money not in the Defense budget. Now that we have returned most of the deployed forces, the Iraqis could make us do it all over again next week or next month. The Israeli defense forces faced a similar problem in the 1970s, when Egypt would mass troops along the canal, and Israel would call up its reserves in response, causing economic chaos. The Egyptians would then withdraw, and the Israelis would pick up the pieces. Over time, they mobilized fewer and fewer forces, relying on "strategic" warning. One day, the Egyptian forces didn't stop at the canal, and Israel barely survived. Why is this different from the long-term problem we face in the Middle East? Is the cost of U.S. forces responding to feints included in the Bomber Study.

Dr. KAMINSKI. The current situation in the Middle East is somewhat different because of significant in-place friendly forces, intelligence resources, and the varied non-military options to respond to such threats. No, the Bomber Study did not include the estimated costs of possible feints by our potential adversaries. Such a prediction would be purely speculation, and impossible to accurately estimate.

Senator NUNN. Dr. Kaminski, your preferred strategy is to buy additional munitions instead of more B–2s. I do not disagree that we should have more munitions; indeed, this committee has long championed buying adequate stocks of precision munitions. The fault, and the probable flaw in this strategy, lies within your Department. Time after time, service budgets "earmarked" to buy precision munitions have been raided by those same services to pay for overruns on their major hardware programs. The end result has been a chronic shortage of precision munitions. What is your plan to insure the kind of cultural change that will be required to keep munitions funding from being diverted to other service "needs?"

Dr. KAMINSKI. The acquisition of additional precision weapons is one of the Department's top modernization efforts. The recently completed Heavy Bomber Study provided additional evidence of the effectiveness of precision weapons as a force multiplier. I have initiated a follow-on study to evaluate the needed quantity and mix of future weapons. The President's budget supports this increased emphasis on precision weapons and the Department will continue to investigate opportunities to speed this modernization effort. We appreciate your committees support of the Department's munitions programs.

Senator NUNN. Dr. Kaminski, most of the advanced weapons in development, including most of those you recommend we spend another $13 billion to acquire, depend on GPS guidance. If even relatively simple jamming takes place, these weapons may be much less effective. If we assume widespread jamming, how does the value of the ability of the B–2, and perhaps the B–1, to use relative targeting enhance their value?

Dr. KAMINSKI. It will likely take more than simple jamming to defeat our GPS aided munitions. Such jammers must be in the correct location, of sufficient power, and be operated at the correct time, for the correct length of time. Operating jammers could be easily located. Once jamming sources are located they could become a target.

Relative targeting with the B–2, B–1, or any of the fighters capable of it reduces the target location error (TLE) for all delivered weapons, GPS guided or not. For weapons like JDAM, TLE can be about half of the GPS aided targeting error—around 7 meters. Reducing TLE in this first case greatly improves the weapons' delivered accuracy. If sufficient GPS jamming is present to suppress the GPS signal, weapons would navigate using only the inertial navigation systems (INS). In this second case the INS error dominates the targeting error (TLE is still 7 meters). INS steering error depends on time of flight for the weapon. For longer times of flight, the loss of GPS guidance could double the JDAM miss distances. If the GPS signal were jammed just prior to weapons impact, there could be little increase in miss distance. However, reducing TLE in that case will still improve their overall performance, but not to the same degree as when the weapon is navigating with a GPS-aided INS.

Senator NUNN. General Welch and General Goodson, in cases where our deployment to land bases in the theater is limited, the draft staff study by the Commission on Roles and Missions recommends using carriers largely as floating platforms on which to base CAP and SEAD assets to defend non-stealthy bombers during the opening phase, rather than using them for offensive purposes, owing to the lack of stealth, range, and payload of carrier air. Is this proposal something that should be further explored?

General WELCH. It is, of course, a very complex issue that you raise, sir. But yes, I do believe that it deserves very thorough exploration. My own considerations in this area have led me to a firm conviction that long-range bombers and carrier aviation have a delicious synergy that has yet to be tested in Joint Doctrine and Operations.

General GOODSON. While it can never hurt to "explore" a proposal, I believe that when we think through the concept carefully, we will find that there is not much to be gained. The same fundamental range and payload limitations of carrier air limit its ability to defend non stealthy bombers during the opening phases since the targets that need to be struck early (air defense surveillance and control elements, aircraft on the ground, weapons of mass destruction) are deep. I believe that the scope of such exploration should be widened to find the "best use" of carrier forces (and all other participating forces) so that the "no non-material solution" provisions of the acquisition directives would automatically be fulfilled. Such exploration demands special methods and techniques of analysis if it is to be successful.

Senator NUNN. Dr. Koleszar, if DOD provided you with a set of equal-cost force tradeoffs, does IDA have the modeling capability to examine the cost effectiveness of more B–2s and fewer of the other forces?

Dr. KOLESZAR. IDA possesses a wide range of analytical tools that would be useful to compare the relative cost effectiveness of alternative force capabilities. When force alternatives have similar missions, that is, the forces are tasked to perform the same or similar tasks such as aircraft striking a set of targets, considerable insight to alternative force capabilities can be gleaned from the models. The problem that arises is that when the force elements to be compared have disparate missions, such as the case when comparing, say, 20 B–2s with a carrier battle group (CVBG), the comparisons become much more complex because the CVBG has capabilities in several mission areas. Such comparisons ultimately involved subjective interpretations of the relative importance of these often markedly different missions.

Senator NUNN. Dr. Koleszar, even if DOD did not provide you with equal-cost tradeoffs, does IDA have the capability to develop your own, perhaps patterned after those identified in the Commission on Roles and Missions staff study?

Dr. KOLESZAR. Yes, we could develop a set of equal-cost force alternatives. But the comments I made regarding comparing forces with disparate missions still apply. I might mention that IDA provided analytical support, including developing the cost estimates of the force tradeoffs you referred to, and documented the results in a report prepared by the FFRDCs for the Commission on Roles and Missions (CORM) staff. The IDA inputs to that report also describe the difficulties of comparing such forces and the critical need to account for these other capabilities. While the CORM staff report makes such comparisons, they do so only for the strike mission and neglect the other missions that the forces are capable of performing. Such comparisons are obviously deficient.

Senator NUNN. Dr. Koleszar, does IDA have the capability to look at a wider range of warning and deployment rate assumptions other than those used in the study?

Dr. KOLESZAR. Yes, we can do that. However, in the Heavy Bomber Force Study, IDA has already analyzed a wide range of warning and deployment rate conditions. It is difficult for me to envision the usefulness of examining conditions beyond those that we have already covered for the scenarios examined in the study.

Senator NUNN. Dr. Koleszar, what would you require, other than Dr. Kaminski's approval, to continue your analyses using different assumptions?

Dr. KOLESZAR. IDA would need tasking from OSD that allowed sufficient time and funding resources to do the required work.

Senator NUNN. Dr. Kaminski, the threat postulated by BMDO for use by its contractors in effectiveness analyses assumes multiple simultaneous launches of dozens of missiles within minutes, as an opening salvo, and total launches numbering in the hundreds during the opening days, with hundreds more in reserve for launch during the campaign. Yet, most of the IDA analysis shows no discernible effect from missile attacks, and most of the relatively few excursions you later asked for simply assume a few days of delay. Did you examine cases in which (a) the enemy systematically attacks our supply lines with missiles, to prevent resupply of the reinforcing forces you assume are so rapidly deployed, or (b) systematically preempts against air bases to limit reinforcements even before the enemy ground force incursion begins?

Dr. KAMINSKI. The Bomber Study used intelligence estimates to estimate the potential threat in the scenarios evaluated. The effect of missile attacks were simulated in some excursions.

Senator NUNN. Dr. Kaminski, will you briefly describe the nature of the assumed theater ballistic missile and cruise missile threats in the years 2006 and 2014 to our forces, the airbases they use, and the ports through which sustaining supplies must pass? What are the assumed numbers available to each foe, what do we assume about launch rates, what accuracies are assumed, does the analysis assume a threat of nuclear, chemical or biological warheads on these missiles, and, if so, are those chemical or biological warheads assumed to be unitary or with submunitions?

Were any missile exchanges actually modeled in the IDA analysis, or are the effects of missile attacks only subsumed in the excursions dealing with delayed arrival of U.S. offensive forces?

Dr. KAMINSKI. The specifics of a threat intelligence summary would be classified. Missile exchanges were not explicitly modeled in the Bomber Study.

[Whereupon, at 5:22 p.m., the subcommittee was adjourned.]

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